FEDERAL REGISTER

VOLUME 14 NUMBER 135

Washington, Friday, July 15, 1949

TITLE 6—AGRICULTURAL CREDIT

Chapter III—Farmers Home Administration, Department of Agriculture

Subchapter B—Farm Ownership Loans

PART 311—BASIC REGULATIONS

SUBPART B—LOAN LIMITATIONS

AVERAGE VALUES OF FARMS AND INVESTMENT LIMITS

For the purposes of Title I of the Bankhead-Jones Farm Tenant Act, as amended, the average value of efficient family-type farm-management units and the investment limit for the county identified below are determined to be as herein set forth. The average value and the investment limit heretofore established for said county, which appear in the tabulations of average values and investment limits under § 311.30, Chapter III, Title 6 of the Code of Federal Regulations (13 F. R. 9381), are hereby superseded by the average value and the investment limit set forth below for said county.

NORTH DAKOTA

County:	*Average value*	*Investment limit*
Williams	$16,000	$12,000

(Sec. 41 (i), 60 Stat. 1066; 7 U. S. C. 1015 (i). Applies secs. 3 (a), 44 (b), 60 Stat. 1074, 1069; 7 U. S. C. 1003 (a), 1018 (b))

Issued this 12th day of July 1949.

[SEAL] CHARLES F. BRANNAN,
Secretary of Agriculture.

[F. R. Doc. 49-5774; Filed, July 14, 1949; 8:47 a. m.]

PART 321—SELECTION OF FARMS

SUBPART C—CERTIFICATION BY COUNTY COMMITTEE

Subpart C, "Certification," in Part 321 of Title 6, Code of Federal Regulations (13 F. R. 9399; 6 CFR 321.41–321.43), is redesignated as "Certification by County Committee," and amended to read as follows:

Sec.
321.41 General.
321.42 Certification of farm.
321.43 Determination of equity and tract valuation.
321.44 Execution of forms.

AUTHORITY: §§ 321.41 to 321.44 issued under sec. 41 (i), 60 Stat. 1066; 7 U. S. C. 1015 (i). §§ 321.41 through 321.43 interpret and apply secs. 1 (c), 2 (a) (2), (b), (d), 3 (a), 42 (c), (d); 60 Stat. 1073, 1074, 1067; 7 U. S. C. 1001 (c), 1002 (a) (2), (b), (d), 1003 (a), 1016 (c), (d). Other statutory provisions interpreted or applied are cited to text.

DERIVATION: §§ 321.41 to 321.44 contained in FHA Instruction 421.3.

§ 321.41 *General.* (a) The County Committee is responsible for: (1) Determining that each farm to be financed with the proceeds of a direct or insured Farm Ownership loan is of such character that there is reasonable likelihood that the making or insuring of the loan with respect to the farm will carry out the purposes of the Bankhead-Jones Farm Tenant Act, as amended; (2) determining the amount which it finds to be the fair and reasonable value of the farm, based upon its normal earning capacity, after contemplated improvements or enlargements are made; (3) recommending the amount and purposes of the loan; and (4) determining that the value of the farm, as acquired, enlarged, or improved will not be in excess of the average value of efficient family-type farm-management units in the county.

(b) The Committee will certify to the above determinations on Form FHA-491, "County Committee Certification," with respect to all loans, except in transfer cases when Form FHA-499, "Recertification by County Committee," will be used. In addition, Form FHA-493, "Equity Determination and Tract Valuation," will be prepared as a supplemental certification in connection with Farm Enlargement loans, Farm Development loans, and subsequent loans.

(c) The County Supervisor will arrange for a meeting of the Committee to personally examine the farm. Forms FHA-596, "Earning Capacity Report," FHA-643, "Farm Development Plan," FHA-14C, "Long-Time Farm and Home Plan," and FHA-14, "Farm and Home Plan," will be made available to the Committee. On the basis of this personal examination of the farm and the information contained in these forms, the Committee will make the necessary determinations with respect to the farm.

§ 321.42 *Certification of farm.* (a) For all Farm Ownership loans the Committee will enter on Form FHA-491 its

(Continued on p. 3915)

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CODIFICATION GUIDE

A numerical list of the parts of the Code of Federal Regulations affected by documents published in this issue. Proposed rules, as opposed to final actions, are identified as such.

CODIFICATION GUIDE—Con.

determination as to (1) the fair and reasonable value of the efficient family-type farm-management unit, based on its normal earning capacity, after contemplated improvements or enlargements are made, except as otherwise provided in paragraph (b) of this section with respect to farms for disabled veterans, and (2) the recommended amount and purposes of the loan.

(b) For a disabled veteran the Committee may certify a farm which is less than an efficient family-type farm-management unit. The total investment in such a farm, computed in accordance with § 311.25 of this chapter, should not be greater than is justified by the cash income available after farm operating and family living expenses are deducted from the sum of farm earnings and pension payments. In certifying such a farm the Committee will make the same determinations and certifications as in the case of an efficient family-type farm-management unit, except that in determining the fair and reasonable value the Committee will consider (1) the Earning Capacity Report, (2) the suitability of the unit to the farming capabilities of the particular disabled veteran and his family, (3) the normal market value of the farm, and (4) other pertinent factors, such as the Long-Time Farm and Home Plan and the Farm Development Plan.

§ 321.43 *Determination of equity and tract valuation.* For a Farm Enlargement loan, a Farm Development loan, or a subsequent loan, Form FHA-493 will be used to record the determination of the amount of the applicant's equity. It also will be used to record the maximum refinancing price of the owned tract, and the maximum purchase price of any tract to be added, as recommended by the appraiser and determined by the Committee.

§ 321.44 *Execution of forms.* Forms FHA-491 and FHA-493 will be signed by at least two members of the Committee.

[SEAL] DILLARD B. LASSETER,
Administrator,
Farmers Home Administration.

JUNE 24, 1949.

Approved: July 12, 1949.

CHARLES F. BRANNAN,
Secretary of Agriculture.

[F. R. Doc. 49-5775, Filed, July 14, 1949; 8:47 a. m.]

TITLE 14—CIVIL AVIATION

Chapter I—Civil Aeronautics Board

[Civil Air Regs., Amdt. 4b-12]

PART 4b—AIRPLANE AIRWORTHINESS; TRANSPORT CATEGORIES

TEMPERATURE ACCOUNTABILITY FOR TAKE-OFF LIMITATIONS FOR TRANSPORT CATEGORY AIRPLANES

Correction

In Federal Register Document 49-5454, appearing at page 3743 of the issue for Thursday, July 7, 1949, the 5th line of § 4b.1223 (b) should read: "V_1 shall be further corrected by the".

[Regulations, Serial No. SR-333]

PART 40—AIR CARRIER OPERATING CERTIFICATE

PART 61—SCHEDULED AIR CARRIER RULES

ISSUANCE OF LOCAL AREA AIR CARRIER OPERATING CERTIFICATES FOR AIRCRAFT UNDER 12,500 POUNDS TAKE-OFF WEIGHT

Adopted by the Civil Aeronautics Board at its office in Washington, D. C., on the 11th day of July 1949.

On April 28, 1949, the Board published in the FEDERAL REGISTER a notice of proposed rule making proposing to amend certain provisions in Parts 40 and 61 which were believed to be impeding initiation of scheduled "feeder line" operations in small aircraft. Comment received as a result of this publication was for the most part favorable to the proposal. However, it also became clear that, in order to establish operating conditions which would establish an appropriate level of safety for operations in small aircraft, amendment of Parts 40 and 61 to delete the requirements believed to be restrictive would be insufficient and that it would be preferable to consider the certification of scheduled operations in aircraft of under 12,500 pounds maximum take-off weight on an individual basis so that operating requirements might be tailored for the particular operation.

The Board so informed the Administrator and suggested that he authorize the initiation of operations by feeder lines in small aircraft in the light of a Board suggested set of requirements which varied to a considerable extent from those of Parts 40 and 61. The Administrator was further advised, however, that the Board did not consider its suggested requirements definitive but believed that, pending the development of appropriate general standards, each applicant's situation should be individually considered.

On the basis of this memorandum the Administrator has taken appropriate steps to authorize the initiation of such operations. However, we believe that it is desirable to differentiate clearly between the certificates issued to air carriers using conventional multiengine aircraft and those using aircraft under 12,500 pounds. The Board, therefore, believes it necessary to issue an appropriate Special Civil Air Regulation designating certificates issued under standards varying from Parts 40 and 61 as Air Carrier Operating Certificates for Local Areas, in order that scheduled operations by air carriers holding temporary certificates of public convenience and necessity may be authorized in aircraft under 12,500 pounds maximum certificated take-off weight.

It will be noted that certificates issued under the provisions of this regulation are limited to a duration of one year. It is intended that appropriate rules of a general nature will be developed before the certificates expire.

Since the public has already been afforded an opportunity to participate in the development of rules on this subject, and since the purpose of this regulation is to permit implementation on an individual basis of the proposals heretofore made in the notice of proposed rule making, it is unnecessary to comply further with notice and rule-making requirements, and since this regulation imposes no additional burden on any person it may be made effective without prior notice.

In consideration of the foregoing the Civil Aeronautics Board hereby makes and promulgates a Special Civil Air Regulation, effective immediately, to read as follows:

The Administrator is hereby authorized to issue temporary air carrier operating certificates of one-year duration to scheduled air carriers holding temporary certificates of public convenience and necessity, authorizing the use of aircraft under 12,500 pounds maximum certificated take-off weight, in accordance with such certification and operating standards as may be established by the Administrator. Such certificates shall be called Air Carrier Operating Certificates for Local Areas.

This regulation shall terminate August 1, 1950, unless sooner superseded or rescinded.

(Secs. 205 (a), 601, 604, 52 Stat. 984, 1007, 1010, 62 Stat. 1216; 49 U. S. C. 425 (a), 551, 554, act of July 1, 1948)

By the Civil Aeronautics Board.

[SEAL] M. C. MULLIGAN,
Secretary.

[F. R. Doc. 49-5807; Filed, July 14, 1949; 8:54 a. m.]

Subchapter B—Economic Regulations

[Serial No. ER-150]

PART 292—CLASSIFICATION AND EXEMPTION OF ALASKAN AIR CARRIERS

LIMITED AIR CARRIER OPERATIONS

Adopted by the Civil Aeronautics Board at is office in Washington, D. C., on the 12th day of July 1949.

Part 292 of the Economic Regulations § 292.3 exempts Alaskan pilot-owners, subject to certain conditions, from secs. 401 (a) and 404 (a) of the act until September 30, 1949. The Board has determined that this exemption should be extended to December 31, 1950, in order to allow pilot-owners a further period for engaging in limited air carrier opera-

tions. It is the purpose of this regulation to effect such extension.

Since this amendment is minor in nature and imposes no additional burden on any person, and extends an existing exemption notice and public procedure hereon are unnecessary.

In consideration of the foregoing the Civil Aeronautics Board hereby amends § 292.3 of the Economic Regulations (14 CFR § 292.3) effective August 15, 1949:

By revising the date appearing in the first sentence of paragraph (d) from "September 30, 1949" to "December 31, 1950".

(Sec. 416, 52 Stat. 1004; 49 U. S. C. 496)

By the Civil Aeronautics Board.

[SEAL] M. C. MULLIGAN, *Secretary.*

[F. R. Doc. 49-5819; Filed, July 14, 1949; 8:53 a. m.]

TITLE 22—FOREIGN RELATIONS

Chapter II—Economic Cooperation Administration

[ECA Reg. 1, as Amended May 3, 1949, Order 3]

PART 201—PROCEDURES FOR FURNISHING ASSISTANCE TO PARTICIPATING COUNTRIES

PROCUREMENT AUTHORIZATION NUMBERS AND DELIVERY DATES

Pursuant to the powers reserved in § 201.24 of ECA Regulation 1, the Administrator hereby waives the provisions of the regulation in the following respect:

Notwithstanding the provisions of §§ 201.3, 201.5 and 201.12, of ECA Regulation 1, as amended May 3, 1949, the following procedures relating to Procurement Authorizations issued by ECA to participating countries will be followed in addition to the procedures therein contained:

1. *Serial number procurement authorizations.* ECA will issue Procurement Authorizations bearing a Procurement Authorization number which will indicate the participating country to which the Procurement Authorization is issued, the commodity code number as listed in the Commodity Code Book dated June 15, 1949, and a serial number. An example of such a Procurement Authorization number is as follows:

38 Participating country	010 Commodity code	3001 Serial No.
France	Bread grains	

Except when issued to cover ocean transportation, the following provisions will be applicable to Serial Number Procurement Authorizations:

(a) Although not indicated in the Procurement Authorization number, the source from which the commodities or services covered by the Procurement Authorization are to be obtained will be specified in the Procurement Authorization.

(b) Procurement Authorizations will not be amended after issuance to provide for value increases, except for minor adjustments and additional payments against individual contracts previously partially financed. If a participating country desires authorization to procure an increased amount of commodities or services, ECA will, in appropriate cases, issue a Procurement Authorization bearing a different serial number to authorize the increase.

(c) Each Procurement Authorization will bear a terminal date for deliveries, and may be used to cover only contracts made on or after the date of issuance, and deliveries made on or after the date of issuance through the terminal date specified.

2. *Delivery Quarter Procurement Authorizations.* Deliveries of commodities and services under Delivery Quarter Procurement Authorizations heretofore or hereafter issued in accordance with § 201.3 need not be promised within the calendar quarter indicated on the Procurement Authorization, and, except when otherwise specified in the Procurement Authorization, may be made at any time after the date of issuance or 60 days prior to the beginning of the quarter, whichever date is earlier, up to and including 90 days subsequent to the last day of the quarter.

3. *Responsibilities of Banking Institutions.* The responsibilities of banking institutions in the United States financing transactions under Procurement Authorizations issued in accordance with the procedures, or subject to the limitations, contained in this Order 3 will be as set forth in § 201.23 of ECA Regulation 1, as amended May 3, 1949.

(Sec. 104 (f), Pub. Law 472, 80th Cong. Interprets or applies secs. 111, 403, Pub. Law 472, 80th Cong., as amended by Pub. Law 47, 81st Cong.)

PAUL G. HOFFMAN, *Administrator for Economic Cooperation.*

[F. R. Doc. 49-5769; Filed, July 14, 1949; 9:32 a. m.]

[ECA Reg. 4, as Amended July 15, 1949]

PART 204—GUARANTIES UNDER THE ECONOMIC COOPERATION ACT OF 1948, AS AMENDED

ECA Regulation 4 is amended in its entirety to read as follows:

Preamble. In furtherance of the purposes of the Economic Cooperation Act of 1948, as amended, in order to facilitate and maximize the use of private channels of trade, and pursuant to authority contained in sections 104 (f) and 111 (a) and (b) of such act, the following rules and regulations are prescribed for the making of guaranties of investments pursuant to section 111 (b) (3) of such act as amended.

AUTHORITY: §§ 204.1 to 204.8 issued under secs. 104 (f) and 111 (a) and (b), Pub. Law 472, 80th Cong., as amended by Pub. Law 47, 81st Cong.

§ 204.1 *Scope of this part.* This part shall cover all guaranties under paragraph 3 of subsection (b) of section 111 of the Economic Cooperation Act of 1948, as amended, except guaranties of projects described in subparagraph (iv) of said paragraph 3.

§ 204.2 *Preliminary statement in regard to applications for guaranties and place of filing.* Applications for guaranties should be made in writing to the Administrator for Economic Cooperation, Washington 25, D. C.

There is no prescribed form of application. Applications should conform as closely as practicable to the requirements for information given below.

§ 204.3 *Information required in applications for guaranties for informational media projects.* Each application for a guaranty for an informational media project shall be submitted in four copies plus one additional copy for each participating country in which it is desired that the project operate, and shall contain, so far as practicable, the following information:

1. Name and address of the applicant.
2. Citizenship of the applicant. (If a corporation, the applicant should indicate the State in which it is incorporated and furnish a statement by an officer showing the percentage of each class of its stock known or believed to be beneficially owned by United States citizens.)
3. Name and title of each person authorized to represent the applicant for the purposes of the application.
4. Brief history of the applicant.
5. Name and address of the applicant's commercial bank.
6. Income statements in reasonable detail, and year-end balance sheets, for each of the past three fiscal years certified by independent accountants, or by a responsible official of the applicant if the applicant's accounts are not ordinarily audited by independent accountants.
7. The participating country or countries for which the project is intended.
8. A brief description of the informational media included in the project. (The title and author of each book, or the title of each motion picture or periodical, should be listed in an appendix. Sample copies of the informational media included in the project should be furnished, if practicable. In the case of periodicals, 6 to 8 copies of a recent issue should be furnished.)
9. A brief description of the business arrangements for the production and distribution of the media. (This should include a statement of where and how the media are produced and of how they will be distributed in the participating country or countries. In the case of periodicals and books, it should also state the proposed retail prices and dealer's discounts in the

participating country or countries, in comparison with those in effect in the United States and elsewhere.)

10. An estimate of the net sales or other receipts in local currency to be received from the project in each participating country for the first six months' period of operation covered by the application, and for the succeeding six months' period of operation. (The applicant should also state whether or not any receipts may be anticipated from the project in dollars or other hard currencies, with estimates whenever practicable.)

11. An estimate of the local currency expenses of operation of the project in each participating country for such first and next succeeding six months' periods of operation.

12. The amount of the guaranty requested for each participating country for such first six months' period of operation, together with a brief explanation of how this amount is arrived at.

13. A brief statement of the reasons why the applicant considers that the project will further the purposes of the Act and be consistent with the national interests of the United States.

14. Such further information as may be relevant.

§ 204.4 *Information required in applications for guaranties for industrial projects.* Each application for a guaranty covered by this regulation, other than a guaranty for informational media, shall be submitted in four copies, and shall contain, so far as practicable, the following information:

1. Name and address of the applicant.

2. Citizenship of the applicant. (If a corporation, the applicant should indicate the State in which it is incorporated and furnish a statement by an officer showing the percentage of each class of its stock known or believed to be beneficially owned by United States citizens.)

3. Name and title of each person authorized to represent the applicant for the purposes of the application.

4. Brief statement of history and experience of the applicant, with commercial bank and trade references, and income statements and year-end balance sheets for each of the past three fiscal years, together with a statement as to the availability of funds for the proposed investment, and the source thereof. The income statements and year-end balance sheets should be certified by independent accountants, or by a responsible official of the applicant if the applicant's accounts are not ordinarily audited by independent accountants.

5. The participating country for which the project is intended and statement of the channels through which negotiations are being or will be conducted for the purpose of obtaining approval of such country.

6. Statement of any special conditions specified by the government of the participating country for the conduct of the business; and any arrangements with the foreign government for the conversion of receipts from the investment into U. S. dollars.

7. Total amount of dollars to be invested by the applicant and the amount of such investment for which a guaranty is requested. Schedule of time for making the investment by quarterly annual periods.

8. Amount of estimated earnings or profits for which an additional amount of guaranty is requested. State total additional amount requested and show breakdown of amount by annual periods.

9. Brief description of securities or instruments to be acquired by applicant as evidence of ownership of the investment to be guaranteed.

10. If any part of the applicant's investment is to be made in a form other than cash, the basis of the valuation thereof in dollars.

11. Statement of the form of organization under which the enterprise in the participating country will be conducted; i. e., whether a branch of applicant, a separate corporation, etc., with latest available balance sheet of the enterprise, is already in existence, and pro forma balance sheet giving effect to the proposed investment.

12. A description of the plant or other facilities to which the investment will relate, its proposed location, and projected method of operation; also a brief statement of arrangements contemplated for management of the enterprise in the participating country.

13. If there are at present any other participants, financial or otherwise, in the enterprise, give their names and state extent and character of their participation; or if participants are numerous, give the required information as to the principal participants.

14. If there are any other proposed participants, financial or otherwise, in the enterprise, give their names and state extent and character of their participation.

15. Estimated time required to place the enterprise in operation.

16. Statement as to how the projected investment may be expected to affect the foreign exchange position of the participating country, or countries, concerned, including an estimate of the U. S. dollar and other imports to be saved, if any, and hard or soft currency exports to result from operation of the project.

17. Information with respect to the market for the products or services resulting from the project (this is to include the domestic market in the participating country, the market in the United States, and the general world export market) and pertinent information with respect to the economic soundness of the project.

18. Any other information to show the desirability of the project as promoting European recovery.

19. A description of all existing investments of the applicant in the participating country.

20. Such further information as may be relevant.

§ 204.5 *Fees for guaranties.* The investor receiving a guaranty shall pay to the Administrator or his duly appointed representatives, annually in advance, a fee equal to the sum of

(a) One percent per annum of the face amount of the guaranty for the immediately ensuing year, plus

(b) One-quarter of one percent per annum of the amount by which the face amount of the guaranty will under the terms of the contract of guaranty increase at any time during the life of the contract,

unless unusual circumstances are found by the Administrator to exist, rendering it desirable, in furtherance of the purposes of the act, to charge a smaller fee, or to charge under paragraph (b) of this section a fee of more than one-quarter of one percent per annum but not exceeding one percent per annum.

In view of the short period for which informational media guaranties are issued, paragraph (b) of this section is not applicable to such guaranties.

§ 204.6 *Designation of Export-Import Bank of Washington as agent.* Export-Import Bank of Washington is hereby designated by the Administrator as his agent, upon such terms as may be specified by the Administrator, to issue in its name and administer guaranties made under section 111 (b) (3) of the Economic Cooperation Act of 1948, as amended, other than guaranties of investments in enterprises producing or distributing informal media, and other than guaranties of projects described in subparagraph (iv) of section 111 (b) (3).

§ 204.7 *Effect of making investment prior to issuance of guaranty.* The primary purpose of the guaranty provisions of the act is to stimulate American investment in aid of European recovery. Where an investment is made prior to the issuance of a guaranty, there is ordinarily no reason for issuing the guaranty. Accordingly, the making of an investment by an applicant prior to the filing of an application for a guaranty of such investment shall be grounds on which the application may be denied.

The making of an investment by an applicant after the filing of an application for guaranty of such investment, but before the issuance of a guaranty, shall be grounds on which the application may be denied. An applicant will, however, be protected against denial of an application on such grounds if, prior to the making of such investment, he shall have obtained in writing a statement from the Economic Cooperation Administration that the investment may be made prior to the issuance of the guaranty without prejudice to applicant's position under the application.

§ 204.8 *Saving clause.* The Administrator may waive, withdraw, or amend at any time or from time to time any or all of the provisions of this part.

PAUL G. HOFFMAN,
Administrator for Economic Cooperation.

[F. R. Doc. 49-5736; Filed, July 14, 1949; 8:45 a. m.]

TITLE 38—PENSIONS, BONUSES, AND VETERANS' RELIEF

Chapter I—Veterans' Administration

PART 21—VOCATIONAL REHABILITATION AND EDUCATION

MISCELLANEOUS AMENDMENTS

Correction

In Federal Register Document 49-5037, published at page 3401 of the issue for Thursday, June 23, 1949, the words "Part VII", appearing in the headnote of § 21.520, should read "Part VIII".

TITLE 43—PUBLIC LANDS: INTERIOR

Chapter I—Bureau of Land Management, Department of the Interior

Appendix—Public Land Orders

[Public Land Order 593]

ALASKA

RESERVING CERTAIN PUBLIC LANDS AS ADMINISTRATIVE RESERVE, AND EXCLUDING PORTION OF SUCH LANDS FROM TONGASS NATIONAL FOREST

By virtue of the authority vested in the President by section 1 of the act of June 4, 1897, 30 Stat. 34, 36 (U. S. C. title 16,

sec. 473), and pursuant to Executive Order No. 9337 of April 24, 1943, and the act of May 31, 1938, 52 Stat. 593 (U. S. C. title 48, sec. 353a), it is ordered as follows:

Subject to valid existing rights and claims, and the provisions of existing withdrawals, the tract of public land described below by metes and bounds is hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws and the mineral leasing laws, and reserved for the use of the natives of the Angoon Community as an administrative reserve.

Beginning at corner No. 1 M. C. of lot 19, U. S. Survey No. 2412, latitude 57°23′ N., longitude 134°24′15″ W., Hood Bay Group of Homesites,

Thence by metes and bounds,

N. 2°47′ W., 2,000 feet along line 1–2, lot 19, and that line extended;

East, 12,000 feet to the mean high tide line of North Arm of Hood Bay;

Southwesterly and westerly along high tide line of Hood Bay to point of beginning;

Excluding therefrom lots 25 and 33 of U. S. Survey No. 2413.

The area described contains approximately 610 acres.

Those portions of the above-described tract which are within the boundaries of the Tongass National Forest as enlarged by Proclamation No. 111 of February 16, 1909, 35 Stat. 2226, are hereby excluded from the said national forest.

J. A. KRUG,
Secretary of the Interior.

JULY 8, 1949.

[F. R. Doc. 49-5766; Filed, July 14, 1949; 8:50 a. m.]

TITLE 49—TRANSPORTATION

Chapter I—Interstate Commerce Commission

Subchapter D—Freight Forwarders

[No. 29493]

PART 400—AGREEMENTS, FORWARDERS-MOTOR COMMON CARRIERS

FREIGHT FORWARDERS; MOTOR COMMON CARRIERS; AGREEMENTS

In the matter of the request for the postponement of the effective date of the order in the above-entitled proceeding.

Upon further consideration of the record in the above-entitled proceeding, and upon consideration of request of the United States District Judge for the District of Delaware, to postpone effective date of order; and for good cause appearing:

It is ordered, That the order entered herein on September 24, 1948 (§ 400.2 *Expiration date prescribed for section 409 of the Interstate Commerce Act*, 13 F. R. 5861), which, by its terms as modified was to have become effective August 1, 1949, upon notice provided in the order of September 24, 1948, is hereby further modified to become effective October 1, 1949, upon like notice.

Notice of this order shall be given to the general public by depositing a copy hereof in the office of the Secretary of the Commission at Washington, D. C., and by filing it with the Director of the Division of the Federal Register.

(60 Stat. 21; 49 U. S. C. 1009 (a) (2))

Dated at Washington, D. C., this 8th day of July A. D. 1949.

By the Commission.

[SEAL] W. P. BARTEL,
Secretary.

[F. R. Doc. 49-5768; Filed, July 14, 1949; 8:46 a. m.]

TITLE 50—WILDLIFE

Chapter I—Fish and Wildlife Service, Department of the Interior

Subchapter C—Management of Wildlife Conservation Areas

PART 32—SOUTHWESTERN REGION

FISHING IN BOSQUE DEL APACHE NATIONAL WILDLIFE REFUGE, NEW MEXICO

Basis and purposes. On the basis of observations and reports of field representatives of the Fish and Wildlife Service it has been determined that fishing privileges on the Bosque del Apache National Wildlife Refuge can be liberalized to conform more nearly to the seasons set by the State of New Mexico.

Since this amendment is a liberalization of the present regulations, the notice and public rule making procedure required by the Administrative Procedure Act (60 Stat. 237, 5 U. S. C. 1001 et seq.) are hereby found to be impracticable and the effective date requirement of the Administrative Procedure Act does not apply.

Effective on the date of publication of this document in the FEDERAL REGISTER § 32.51 is revised to read as follows:

§ 32.51 *Fishing permitted.* Noncommercial fishing is permitted in the waters of the Bosque del Apache National Wildlife Refuge specified in § 32.52 in accordance with the provisions of Parts 18 and 21 of this chapter and subject to the conditions, restrictions, and requirements of §§ 32.52 to 32.57.

(50 CFR 21.41; 13 F. R. 9351)

Dated: July 8, 1949.

O. H. JOHNSON,
Acting Director.

[F. R. Doc. 49-5764; Filed, July 14, 1949; 8:46 a. m.]

PART 34—SOUTHEASTERN REGION

HUNTING IN NOXUBEE NATIONAL WILDLIFE REFUGE, MISSISSIPPI

Basis and purposes. On the basis of observations and reports of field representatives of the Fish and Wildlife Service it has been determined that there is an overabundant population of raccoons, opossums, bobcats, squirrels, and foxes which must be removed from the refuge as expediently as possible. Because of the low value of the pelts of these animals it is inadvisable to attempt to take them by trapping. It has, therefore, been determined that the wildlife management objectives can best be accomplished by allowing these animals to be taken by public hunting.

Since the following regulations are relaxations of the present prohibition against hunting and the use of dogs on the Noxubee National Wildlife Refuge, the notice and public rule making procedure required by the Administrative Procedure Act (60 Stat. 237, 5 U. S. C. 1001 et seq.) are hereby found to be impracticable and the effective date requirement of the Administrative Procedure Act does not apply.

Effective on the date of publication of this document in the FEDERAL REGISTER the following subpart is added:

SUBPART—NOXUBEE NATIONAL WILDLIFE REFUGE, MISSISSIPPI

HUNTING

AUTHORITY: §§ 34.107 to 34.109 issued under 50 CFR 21.31; 13 F. R. 9350.

§ 34.107 *Hunting permitted.* Raccoons, opossums, bobcats, squirrels, and foxes may be taken in accordance with the laws and regulations of the State of Mississippi on such lands of the United States within the Noxubee National Wildlife Refuge as may be designated by suitable posting following an annual examination of the refuge by representatives of the Fish and Wildlife Service, subject to the provisions, conditions, restrictions, and requirements of §§ 34.108 and 34.109.

§ 34.108 *Entry.* Entry on and use of the refuge for any purpose are governed by the regulations in Parts 18 and 21 of this chapter, and strict compliance therewith is required. All hunters must comply with State hunting laws and regulations and must have on their person and exhibit at the request of any authorized Federal or State officer whatever license or licenses may be required by such laws and regulations, which license shall serve as a Federal permit.

§ 34.109 *Dogs.* Each person hunting raccoons, opossums, bobcats, or foxes on the public hunting ground will be permitted to take his hunting dogs upon such areas, provided he shall first have secured a permit from the Refuge Manager specifying the number of dogs that will be used, the area in which the hunting may be conducted, and the period during which such dogs shall be allowed on the refuge. Dogs used for raccoon, opossum, bobcat, and fox hunting on the refuge shall at all times be under the general control of their owner or handler and shall not be permitted to run at large on the public hunting ground or elsewhere on the refuge.

Dated: July 8, 1949.

[SEAL] O. H. JOHNSON,
Acting Director.

[F. R. Doc. 49-5765; Filed, July 14, 1949; 8:50 a. m.]

PROPOSED RULE MAKING

DEPARTMENT OF AGRICULTURE

Production and Marketing Administration

[7 CFR, Part 53]

GRADING AND CERTIFICATION OF MEATS, PREPARED MEATS, AND MEAT PRODUCTS

NOTICE OF PROPOSED INSTRUCTIONS ON INSPECTION REQUIREMENTS CONCERNING PRODUCTS TO BE GRADED

Notice is hereby given in accordance with section 4 (a) of the Administrative Procedure Act (5 U. S. C. 1003 (a)) that the Administrator of the Production and Marketing Administration, United States Department of Agriculture, is considering the adoption of the following instructions on inspection requirements concerning the grading and certification of meats, prepared meats, and meat products, pursuant to the authority vested in him by §§ 53.2 (l) and 53.3 of the regulations governing such grading and certification (7 CFR 53.2 (l) and 53.3) under the Agricultural Marketing Act of 1946 (7 U. S. C. 1621–1627) and the so-called Farm Products Inspection Act consisting of the item for market inspection of farm products recurring each year in the annual appropriation act for the Department of Agriculture and currently found in the Department of Agriculture Appropriation Act, 1950, (7 U. S. C. Sup. 414).

§ 53.3a *Instructions regarding inspection requirements concerning products to be graded*—(a) *Definitions for determining compliance with inspection requirements.* Under § 53.2 (l) products, to be eligible for grading service, must be prepared under Federal inspection or other official inspection acceptable to the Administrator. In determining such eligibility the following definitions shall apply.

(1) "Federal inspection" shall mean the meat inspection system conducted under the Meat Inspection Act of March 4, 1907, as amended (21 U. S. C. 71–91) and the regulations promulgated thereunder (9 CFR 1.1 et seq.).

(2) "Other official inspection acceptable to the Administrator" shall mean any meat inspection system which (i) is conducted under the authority of laws, ordinances, or similar enactments of the State, county, city, or other political subdivision in which is located the plant at which the products are prepared; and (ii) imposes at least the requirements set forth in paragraphs (b) and (c) of this section: *Provided*, That, no such inspection system shall be deemed acceptable to the Administrator with respect to any particular plant in which products to be graded are prepared if he finds at any time that such requirements are not adequately enforced with respect to such plant.

(b) *Requirements as to manner of inspection and operation of plant.* (1) The inspection shall be conducted by inspectors who are qualified veterinarians or who are supervised by qualified veterinarians. All such inspectors shall be employed and assigned by the State, county, city, or other political subdivision in which the plant is located.

(2) The inspection shall include antemortem and post-mortem inspection. The inspector shall examine each animal immediately prior to slaughter for the purpose of eliminating all unfit animals and segregating, for more thorough examination, all animals suspected of being affected with a condition which might influence their disposition on post-mortem inspection. The unfit animals shall not be permitted to enter the slaughtering department of the plant, and the suspected animals shall not be permitted to enter the slaughtering department until they shall have been found by veterinary inspection to be fit for slaughter. The suspected animals that are permitted to be slaughtered shall be handled separate and apart from the regular kill and given a special post-mortem examination.

(3) The post-mortem examination shall be made at the time the animals are slaughtered. The inspectors shall examine the cervical lymph glands, the skeletal lymph glands, the viscera and organs with their lymph glands, and all exposed surfaces of the carcasses of all cattle, calves, sheep, swine, and goats. Such examinations shall be conducted in the slaughtering department of the plant during the slaughtering operations.

(4) All of the operations in the slaughtering and allied departments of the plant shall be conducted in a clean and sanitary manner. Facilities shall be provided for the prompt cleaning and sterilization of any contaminated equipment.

(5) All diseased or otherwise unfit carcasses and parts of carcasses, including the viscera, shall be condemned and removed from the slaughtering department of the plant in equipment designated for that purpose, and shall be destroyed for food purposes under the supervision of an inspector. The disposition of all carcasses and parts thereof, including the viscera, shall be under the control of a veterinary inspector.

(6) Each carcass and part thereof which has been inspected and passed shall be stamped with an identifying mark assigned by the State, county, city, or other political subdivision, as the case may be, under the supervision of the inspector, and the marking device shall be in the custody of the inspector at all times.

(c) *Requirements as to sanitation of plant and premises.* (1) (i) The plant and its facilities shall be well constructed, properly fitted and equipped for the purpose used, and so maintained that products intended for human food prepared therein will be clean, sound, healthful, and wholesome. The floors of the plant shall be smooth and impervious and so laid as to drain freely and rapidly to sewer connections. Walls and pillars in the slaughter rooms must be tight, smooth, and free from crevices and, with other parts, shall be kept clean.

(ii) Rooms used for condemned products, inedible offal, hides, and other materials and supplies likely to contaminate or render products inedible shall be completely partitioned from edible product departments and rooms except for one aperture to the slaughtering department. The aperture shall be equipped with a close-fitting door and shall be of sufficient size to allow ready and free passage of materials designated as unfit for human food and all equipment used therewith.

(2) Drainage and sewage disposal must be adequate to maintain the plant and premises in a sanitary condition.

(3) Ventilation shall be sufficient to insure that the atmosphere in rooms where edible product is kept is free from obnoxious odors emanating from inedible tank and offal rooms, catch basins, toilet rooms, hide cellars, refuse heaps, livestock pens, and similar sources. Lighting shall be adequately maintained in all rooms.

(4) The plant shall be provided with ample supplies of potable hot and cold water, with outlets conveniently located and equipped with faucets for hose connections, for ready use during slaughtering operations and for cleaning. Wash basins equipped with running hot and cold water, soap, and towels shall be placed in or near the dressing rooms and at such other places in the establishment as may be essential to insure cleanliness of all persons handling products. Water for sterilizing purposes shall be maintained at a temperature of at least 180° F.

(5) Toilet rooms shall not communicate directly with any room in which animals are killed or food products thereof are processed, handled, or stored. Dressing room facilities must be adequate for cleanliness and convenience.

(6) All departments in the plant must have adequate protection against flies, rodents and other vermin. However, the use of poisons for any purpose in rooms or compartments where any unpacked articles intended for human food are stored or handled is forbidden except under such restrictions and precautions as the chief veterinary inspector in charge of inspection at the plant may require. So-called rat viruses shall not be used in any part of the plant or its premises.

(7) Equipment and utensils used in the plant must be made of such material and be so constructed as to be readily and thoroughly cleaned, and shall be kept clean and in sanitary condition. Facilities must be provided for cleaning and sterilizing equipment, tools, and utensils.

(8) Barnyards, stock runs, pens, loading docks, and other facilities appurtenant to the plant shall be kept clean. No nuisance shall be allowed on the premises, such as fly breeding places, dead stock, rat infestation, cockroach infestation, rubbish heaps, decomposing animal material, polluted water supply, insanitary drainage disposal, leaking floors, or the like.

(d) *Definitions made applicable.* Definitions contained in § 53.2 of terms used in this section shall apply to such terms.

The purpose of the proposed instructions will be to specify the type of meat inspection system under which a plant must operate in order that its products will be eligible for Federal grading service under the regulations governing the grading and certification of meats, prepared meats, and meat products (7 CFR Part 53).

Any person who wishes to submit written data, views, or arguments concerning the proposed instructions may do so by filing them with the Director of the Livestock Branch, Production and Marketing Administration, United States Department of Agriculture, Washington 25, D. C., within fifteen days after the date of publication of this notice in the FEDERAL REGISTER.

Done at Washington, D. C., this 11th day of July 1949.

[SEAL] JOHN I. THOMPSON,
Assistant Administrator, Production and Marketing Administration.

[F. R. Doc. 49-5805; Filed, July 14, 1949; 8:53 a. m.]

[7 CFR, Part 940]

PEACHES GROWN IN THE COUNTY OF MESA IN COLORADO

NOTICE OF PROPOSED RULES AND REGULATIONS

Notice is hereby given, pursuant to the Administrative Procedure Act, approved June 11, 1946, that consideration is being given to the following proposed administrative rules and regulations submitted by the Control Committee functioning under the marketing agreement and Order No. 40 (7 CFR Part 940), regulating the handling of peaches grown in the County of Mesa in Colorado, effective under the applicable provisions of the Agricultural Marketing Agreement Act of 1937, as amended:

§ 940.100 *Definitions.* (a) "Marketing agreement and order" means Marketing Agreement No. 88 and Order No. 40 (7 CFR Part 940) regulating the handling of peaches grown in the County of Mesa in the State of Colorado.

(b) All terms used herein shall have the same meaning as when used in the marketing agreement and order.

§ 940.101 *General.* Unless otherwise provided in the marketing agreement and the order or by specific direction of the Administrative Committee, all reports, applications, submittals, requests, and communications in connection with the marketing agreement and order shall be addressed to "Administrative Committee, P. O. Box 368, Palisade, Colorado".

§ 940.104 *Exemption certificates.* (a) Each application for an exemption certificate shall be submitted on Form A "Application for Exemption from Grade and Size Regulation," which may be obtained from the Administrative Committee, and shall contain the following information:

(1) Name and address of applicant;

(2) Location of each orchard from which peaches will be shipped pursuant to the exemption certificate requested;

(3) Estimated total production of peaches from such orchard and all other orchards owned or controlled by such applicant;

(4) Estimated percentage of peaches of such production which cannot be shipped because of the then effective (i) grade regulation, and (ii) size regulation, together with the reasons why such percentage fails to meet the requirements of the grade and size regulations; and

(5) The total quantity of such peaches which the applicant sold since the beginning of the then current Elberta peach shipping season.

Each such application shall be accompanied by a statement of an authorized representative of the Federal-State Inspection Service showing that he has checked the orchards identified in such application and that he has determined, from a representative sample of the peaches, the percentage of such peaches which will meet the requirements of the aforesaid grade and size regulations; and such percentage shall be set forth in such statement.

(b) In the event the Administrative Committee finds that the applicant is entitled to an exemption certificate, it shall issue, or cause to be issued, an appropriate form of exemption certificate. If the Administrative Committee finds that the applicant is not entitled to an exemption certificate, it shall so advise the applicant promptly in writing and state the reasons therefor.

(c) Each producer who ships peaches, or causes peaches to be shipped, pursuant to an exemption certificate, shall submit promptly to the Administrative Committee an accurate report with respect to the disposition of each such shipment, and the date and quantity thereof.

§ 940.105 *Reports.* Each handler shall, with respect to all peaches shipped by him each day, promptly report, or cause to be reported, to the Administrative Committee the point of origin of each shipment, the number and type of packages, the grades and sizes of the peaches, and the number of the railroad car or the license number of the truck in which such peaches were shipped.

§ 940.107 *Peaches for charitable purposes.* Any person who ships peaches for consumption by charitable institutions or for distribution by relief agencies shall, prior to making each such shipment, furnish satisfactory proof to the Administrative Committee that said peaches will be used for the aforesaid purposes and not otherwise.

All persons who desire to submit written data, views, or arguments for consideration in connection with such proposed rules and regulations may do so by mailing the same to the Director, Fruit and Vegetable Branch, Production and Marketing Administration, Room 2077, South Building, Washington 25, D. C., not later than the tenth day after the publication of this notice in the FEDERAL REGISTER.

Issued this 11th day of July 1949.

[SEAL] S. R. SMITH,
Director, Fruit and Vegetable Branch, Production and Marketing Administration.

[F. R. Doc. 49-5804; Filed, July 14, 1949; 8:53 a. m.]

CIVIL AERONAUTICS BOARD

[14 CFR, Part 45]

SCHEDULED INTRASTATE COMMERCIAL OPERATOR

CERTIFICATION AND OPERATION REQUIREMENTS

Pursuant to authority delegated by the Civil Aeronautics Board to the Bureau of Safety Regulation, notice is hereby given that the Bureau will propose to the Board a Special Civil Air Regulation as hereinafter set forth.

Interested persons may participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Communications should be submitted to the Civil Aeronautics Board, attention Bureau of Safety Regulation, Washington 25, D. C. All communications received within 30 days from the date of publication will be considered by the Board before taking further action on the proposed rule.

Part 45 currently requires all persons engaging in the carriage in air commerce of goods or passengers for compensation or hire to operate under the same or equivalent safety requirements as those required of air carriers engaging in other than scheduled operations. Since air commerce as defined in the Civil Aeronautics Act of 1938, as amended, embraces any operation of aircraft on any civil airway or any operation of aircraft which directly affects or which may endanger safety in interstate air commerce, and since the Board has determined that the "operation of any aircraft in the airspace overlying the United States either directly affects, or may endanger safety in, interstate, overseas, or foreign air commerce,"[1] it is clear that the current provisions of Part 45 apply to scheduled intrastate operation of aircraft.

However, the Board does not believe that Part 45 presently provides appropriate certification and operating requirements for a commercial operator who is conducting scheduled passenger operations, since the scheduled nature of such operations places these operators in the same category from the point of view of air safety as scheduled (feeder) air carriers operating under Parts 40 and 61. Thus, the Board proposes to amend Part 45 to require commercial operators who are conducting an intrastate scheduled operation to comply with certification and operation requirements generally comparable to those required of the feeder air carriers to whose opera-

[1] See Civil Aeronautics Board Regulations Serial Number 193, adopted October 10, 1941.

tions scheduled intrastate operations bear close resemblance, at least from a safety viewpoint. The major additional requirements which this proposal would make generally applicable to scheduled intrastate passenger operations are as follows:

(a) Company communications and dispatching systems,

(b) Pilot route qualifications, and

(c) Company maintenance organization.

In order to simplify administration of the regulations and to avoid unnecessary duplication of certificates, it is proposed to authorize the air carriers to conduct such limited private carriage operations as may be properly conducted by a common carrier without obtaining a commercial operator certificate, unless the air carrier holds only a Part 42 certificate and operates as a common carrier between two points entirely within a State with the frequency set forth in § 45.3 (a). Of course, any private carriage operations by an air carrier would be subject to the operating requirements of Part 42 of this chapter through the provisions of this part. It will also be noted that for similar reasons we are proposing to require that where operations between points entirely within a State are conducted with the frequency set forth in § 45.3 (a), that all operations between such points be conducted under the requirements of Part 61 of this chapter. We believe that these provisions which are important for adequate administration and enforcement of the part do not impose any undue additional burden on an operator.

For the convenience of interested persons, the entire text of Part 45 is set forth with the proposed amendments. It is believed that these amendments are reasonable and are necessary to provide adequately for safety in air commerce.

It is proposed to amend Part 45, effective January 1, 1950, to read as follows:

§ 45.1 *Applicability of part.* The provisions of this part shall be applicable to citizens of the United States engaging in the carriage in air commerce of goods or passengers for compensation or hire, unless such carriage is conducted under the provisions of an air carrier operating certificate issued by the Administrator. For the purpose of this part, student instruction, banner towing, crop dusting, seeding, and similar operations shall not be considered as the carriage of goods or persons for compensation or hire.[1]

§ 45.2 *Certificate required.* No person subject to the provisions of this part shall engage in air commerce using aircraft of 12,500 pounds or more certificated maximum take-off weight until he has obtained from the Administrator a commercial operator certificate: *Provided*, That any such person may engag in operations subject to the provisions of this part without a commercial operator certificate until such time as the Administrator shall pass on his application for such certificate, but in no case later than January 1, 1950, if he (a) is engaged in such operations on the date of adoption of this part and (b) has filed with the Administrator an application for such certificate not later than June 1, 1949: *Provided further*, That no person holding an air carrier operating certificate shall be required to obtain or be eligible for any commercial operator certificate unless he holds only an air carrier operating certificate issued pursuant to Part 42 and conducts or intends to conduct flights between two or more points within a State with the frequency set forth in § 45.3 (a).

§ 45.3 *Certification requirements.* A commercial operator certificate shall be issued to an applicant who demonstrates to the Administrator that he is capable of conducting his operations in accordance with the provisions of Part 42 of this chapter as heretofore or hereafter amended, or at an equivalent level of safety: *Provided*, That an applicant who carries or intends to carry passengers for compensation or hire as a common carrier between any two points entirely within any State with the frequency set forth in paragraph (a) of this section shall demonstrate that he is capable of conducting those operations in accordance with the requirements of Part 40, as heretofore or hereafter amended (excepting §§ 40.0 and 40.10 of this chapter), or with such other certification requirements as the Administrator finds will provide an appropriate level of safety for the operation.[2]

(a) Two flights, or one round trip, a week on the same day or days of the week for any eight or more weeks in any 90 consecutive days; or four or more flights, or two or more round trips, a week for any eight or more weeks in any 90 consecutive days; or a total of 38 or more flights, or 19 or more round trips, in any 90 consecutive days.

§ 45.4 *Operating rules.* (a) Except as provided in paragraph (b) of this section, all persons subject to the provisions of this part shall, in the conduct of operations subject hereto, comply with the operating requirements of Part 42 of this chapter as heretofore or hereafter amended, except that no person shall be required to comply with the provisions of § 42.12, fire prevention requirements, until January 1, 1950. Operating requirements shall be deemed to include requirements relating to aircraft and equipment, maintenance, flight crew, flight time limitations, flight operation, aircraft operating limitations, and related record-keeping and reporting requirements.

(b) Persons subject to the provisions of this part who conduct common carrier operations subject hereto between points entirely within a State with the frequency described in § 45.3 (a) shall, in the conduct of all operations between such points, comply with the requirements of Part 61 of this chapter, as heretofore or hereafter amended, except §§ 61.0 and 61.00, or with such other operating requirements as the Administrator finds will provide an appropriate level of safety for the operation.

§ 45.5 *Certificate rules.* The certificate rules prescribed in §§ 42.5 through 42.9 of this chapter shall be applicable to commercial operator certificates.

These amendments are proposed under the authority of Title VI of the Civil Aeronautics Act of 1938, as amended, particularly sections 601 (a) (6) and 607 (3).

(Secs. 205 (a), 601–610, 52 Stat. 984, 1007–1012, 62 Stat. 1216; 49 U. S. C. 425 (a), 551–560, act of July 1, 1948)

Dated: July 12, 1949, at Washington, D. C.

By the Bureau of Safety Regulation.

[SEAL] JOHN M. CHAMBERLAIN, *Director.*

[F. R. Doc. 49-5806; Filed, July 14, 1949; 8:54 a. m.]

[1] Under circumstances where it is doubtful whether the operations are for "compensation or hire," the test to be applied is whether the air carriage is merely incidental to the operator's other business or is, in and of itself, a major enterprise for profit.

[2] Note that an air carrier holding an air carrier operating certificate issued under the provisions of Part 42 of this chapter may not conduct intrastate operations with the frequency specified in § 45.3 (a) without first obtaining a commercial operator certificate.

FEDERAL SECURITY AGENCY

Food and Drug Administration

[21 CFR, Part 19]

[Docket No. FDC-46]

CHEESES, PROCESSED CHEESES, CHEESE FOODS, CHEESE SPREADS, AND RELATED FOODS; DEFINITIONS AND STANDARDS OF IDENTITY

NOTICE OF ORDER EXTENDING TIME FOR FILING WRITTEN EXCEPTIONS TO TENTATIVE ORDER

On April 15, 1949, notice of proposed rule making was issued by the Acting Federal Security Administrator, and published in the FEDERAL REGISTER of April 22, 1949 (14 F. R. 1960 et seq.). The said notice provided that any interested person whose appearance was filed at the hearing may, within 90 days from the date of publication, file with the Hearing Clerk, Federal Security Agency, Room 5109, Federal Security Building, Fourth Street and Independence Avenue SW., Washington, D. C., written exceptions thereto, which may be accompanied by a memorandum or brief in support thereof.

The Federal Security Administrator having been petitioned by interested persons to extend the period of time within which such exceptions and supporting memoranda or briefs may be filed, and good cause therefor appearing, *It is ordered*, That the time for filing exceptions and supporting memoranda or briefs is hereby extended for a period of thirty days beginning on July 22, 1949, and that said extension shall apply to all interested persons whose appearances were filed at the hearing.

Dated: July 12, 1949.

[SEAL] J. DONALD KINGSLEY, *Acting Administrator.*

[F. R. Doc. 49-5791; Filed, July 14, 1949; 8:51 a. m.]

[21 CFR, Part 52]

[Docket No. FDC-55]

CANNED MUSHROOMS; DEFINITIONS AND STANDARDS OF IDENTITY

NOTICE OF HEARING

In the matter of proposals to amend the definitions and standards of identity for canned mushrooms:

Notice is hereby given that the Federal Security Administrator, upon application of a substantial portion of the interested industry stating reasonable grounds therefor, and in accordance with the provisions of sections 401 and 701 of the Federal Food, Drug, and Cosmetic Act (52 Stat. 1046, 1055; 21 U. S. C. 341, 371), will hold a public hearing commencing at 10:00 o'clock in the morning of August 18, 1949, in Room 5742, Federal Security Building, Independence Avenue and Fourth Street SW., Washington, D. C., upon the applicant's proposal to amend the definitions and standards of identity for canned vegetables other than those specifically regulated (21 CFR, Cum. Supp., 52.990), insofar as they relate to canned mushrooms, to provide for the use of ascorbic acid in limited amounts as an optional ingredient, and to provide for label statement of such optional ingredient.

Mr. Edward E. Turkel is hereby designated as presiding officer to conduct the hearing in the place of the Administrator, with full authority to administer oaths and affirmations and to do all other things appropriate to the conduct of the hearing. The presiding officer is required to certify the record of this hearing to the Administrator for initial decision.

The hearing will be conducted in accordance with the rules of practice provided therefor. Evidence will be restricted to that which is material and relevant to the subject matter of the proposals.

The proposals are subject to adoption, rejection, amendment, or modification, in whole or in part, as the evidence may require.

Dated: July 11, 1949.

[SEAL] J. DONALD KINGSLEY,
Acting Administrator.

[F. R. Doc. 49-5792; Filed, July 14, 1949; 8:51 a. m.]

NOTICES

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

ALASKA

NOTICE FOR FILING OBJECTIONS TO PUBLIC LAND ORDER RESERVING CERTAIN PUBLIC LANDS AS ADMINISTRATIVE RESERVE, AND EXCLUDING PORTION OF SUCH LANDS FROM TONGASS NATIONAL FOREST [1]

For a period of 60 days from the date of publication of the above entitled order, persons having cause to object to the terms thereof may present their objections to the Secretary of the Interior. Such objections should be in writing, should be addressed to the Secretary of the Interior, and should be filed in duplicate in the Department of the Interior, Washington 25, D. C. In case any objection is filed and the nature of the opposition is such as to warrant it, a public hearing will be held at a convenient time and place, which will be announced, where opponents to the order may state their views and where the proponents of the order can explain its purpose, intent, and extent. Should any objection be filed, whether or not a hearing is held, notice of the determination by the Secretary as to whether the order should be rescinded, modified or let stand will be given to all interested parties of record and the general public.

J. A. KRUG,
Secretary of the Interior.

JULY 8, 1949.

[F. R. Doc. 49-5767; Filed, July 14, 1949; 8:50 a. m.]

[1] See F. R. Doc. 49-5766, Title 43, Chapter I, Appendix, *supra*.

CIVIL AERONAUTICS BOARD

PROPOSED ANNEX 8 TO CONVENTION ON INTERNATIONAL CIVIL AVIATION, "AIRWORTHINESS OF AIRCRAFT"

The Bureau of Safety Regulation of the Civil Aeronautics Board hereby publishes for the information of interested persons the complete text of Annex 8 to the Convention on International Civil Aviation, "Airworthiness of Aircraft."

On March 1, 1949, the ICAO Council adopted Annex 8 as an international standard. As provided in the Convention, adoption of this document followed the democratic procedure of submission to vote of the member states on the Council and was favored by more than the required two-thirds of such states. Pursuant to Article 90 of the Convention, it is now being submitted for consideration by each member state, and, if it should be disapproved in whole or in part by a majority of such states, the Annex or any part thereof would have no further effect. The Council has established September 1, 1949, as the date prior to which notice of disapproval shall be given.

Annex 8, or such parts thereof as are not disapproved by a majority of member states, will come into force on October 1, 1949. Even if not disapproved as provided in Article 90, there is still open to individual states the course of filing notice with ICAO of their intention to retain different rules than those provided in paragraphs 1, 2, 4, 5, and 6 of Part II of Annex 8. October 1, 1949, has been established as the date prior to which notice of national differences from these paragraphs shall be filed.[1] It will be noted that the Council's resolution of adoption of Annex 8 does not provide for notification of national differences from other paragraphs of Annex 8 than those previously referred to. Such provision is not made because the remaining parts of the Annex establish requirements for international transport category airplanes, and it is not intended that an airplane can be certificated in an ICAO category unless it complies with the established international standards, except for variations in detail which are considered to give an equivalent level of safety.

The complete text of Annex 8 is being presented for the information and consideration of interested persons in order that the Civil Aeronautics Board and the Civil Aeronautics Administration may be advised fully as to the part or parts of the Annex which are considered to be unsuitable for an international standard or which, if incorporated in the Civil Air Regulations, may impose an undue burden on the aviation industry of the United States.

The comments received will be individually considered in formulating the positions to be taken by the Civil Aeronautics Board and the Civil Aeronautics Administration with respect to disapproval of the Annex in whole or in part. In order that such comments may be fully studied prior to formulation of the Civil Aeronautics Board's and the Civil Aeronautics Administration's positions,[2] it is requested that they be sent to the Bureau of Safety Regulation, Civil Aeronautics Board, Washington 25, D. C., prior to July 20, 1949.

The comments received will be utilized in considering any differences from paragraphs 1, 2, 4, 5 and 6 of Part II of Annex 8, notice of which may appear to be desirable for filing with ICAO.

The Civil Aeronautics Board will also consider the comments in formulating any amendments to the Civil Air Regulations which may be found necessary or desirable. It will be noted, however, that amendments to the Civil Air Regulations will be adopted only upon compliance with the provisions of the Administrative Procedure Act.

Dated: June 22, 1949, at Washington, D. C.

[1] The dates contained in the resolution of adoption in Annex 8 as printed were reconsidered by the Council on May 24th, 1949, and were established as mentioned heretofore.

[2] It will be noted that the United States' position on approval or disapproval of an Annex is ultimately developed through the medium of the Air Coordinating Committee on which the Board and the CAA, respectively, are represented.

By the Bureau of Safety Regulation.

[SEAL] JOHN M. CHAMBERLAIN,
Director.

ANNEX 8 TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

STANDARDS AND RECOMMENDED PRACTICES; AIRWORTHINESS OF AIRCRAFT

The present Annex, adopted by the Council of ICAO on March 1st, 1949, will become effective on September 1st, 1949 unless in the meantime more than half the total number of contracting states have disapproved it in whole or in part. Further details of the Council's action on the subsequent implementation of the Annex will be found in the foreword.

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HISTORICAL INTRODUCTION

At Chicago in November 1944, the International Civil Aviation Conference, at which fifty-two States were represented, drew up an Interim Agreement on International Civil Aviation and a Convention on International Civil Aviation that was to supersede it. The Conference further prepared draft technical annexes to the Convention and resolved that they should be accepted as models of scope and arrangement to be studied by participating States who understook to submit comments on them by May 1st, 1945. The comments were to be considered by technical committees established by the Provisional International Civil Aviation Organization and the annexes, in their final form, accepted for attachment to the Convention. Meanwhile, States of the world were urged to accept the recommended practices contained in the draft technical annexes as those towards which the national practices of the several States should be directed as rapidly and as far as might prove practicable.

The Provisional International Civil Aviation Organization was formed on June 6th, 1945, and the Interim Council convened on August 15th, 1945. It immediately began to improve the technical annexes by preparing PICAO's Recommendations for Standards, Practices and Procedures drafted in meetings by technical experts from Member States and international organizations. The meetings were those of sub-committees, the nomenclature of which was subsequently changed to Divisions of the Air Navigation Committee. Divisions dealing with Rules of the Air and Air Traffic Control, Communications and Radio Aids to Navigation, Meteorology, Aerodromes, Air Routes and Ground Aids, Search and Rescue, Accident Investigation, Personnel Licensing, Operating Practices and Airworthiness all met twice, the Aeronautical Maps and Charts Division met three times and the Special Radio Technical Division met once. Under ICAO, each of the following Divisions has held a further session: Rules of the Air and Air Traffic Control, Aerodromes, Air Routes and Ground Aids, Personnel Licensing, Aeronautical Maps and Charts, and Communications and Radio Aids to Navigation.

The Divisions were aided in improving their recommendations by the comments of technical experts representing both Member and non-member States of the Organization and other international organizations at seven Regional Air Navigation Meetings and several special meetings. Moreover, the technical experts and administrative authorities of all States were accorded three months in which to scrutinize and comment upon the Recommendations of each Division. Meanwhile, under the Interim Agreement, Member States undertook to apply as rapidly as possible in their national civil aviation practices the PICAO Recommendations for Standards, Practices and Procedures.

ICAO came into being on April 4th, 1947. On June 20th, 1947, the ICAO Council recommended that Contracting States should continue to apply in their national civil aviation practices the Rec-

ommendations for Standards and Recommended Practices of PICAO and that they should similarly apply, insofar as they individually considered it advisable and appropriate, the divisional recommendations on which the Council had not yet acted. Many Contracting States made progress in this direction.

The First Assembly of ICAO expressed general satisfaction with the Recommendations for Standards, Practices and Procedures proposed by the Divisions, but decided to rename them henceforth International Standards and Recommended Practices. It resolved (Resolution A1-33) that the Council should examine them in the light of the definitions already promulgated and of the comments of Contracting States and should adopt, as soon as practicable, those on which substantial agreement had been reached. Recommendations that failed to meet these requirements should be referred to the Technical Divisions.

Clarification was necessary between Articles 38 and 90 of the Convention and there was uncertainty when Standards would come into effect and when Contracting States would comply with them or give notice of non-compliance. It was considered that Contracting States should have reasonable time to implement a Standard after learning that it had become effective under Article 90. It was also recognized that the time required would not be the same for all Standards. Accordingly, the Council adopted the following Resolution on July 1st, 1947:

The Council resolves that it shall:

(1) Establish a date, normally ninety (90) days after the date of submission by the Council, after which States may no longer notify disapproval under Article 90;

(2) Establish a further date by which International Standards and Recommended Practices shall be applied by Contracting States. In establishing this date the Council shall take into consideration the problems involved in each instance, the comments of Contracting States, and the recommendations made by appropriate ICAO meetings;

(3) Establish a date prior to which States unable to comply are expected to give notification to that effect. This date shall be sufficiently in advance of the date set for application of the Standards to enable notification of non-compliance to reach ICAO from the States concerned, to be circulated by ICAO to other Contracting States, and to be circulated by Contracting States to those concerned.

As requested by certain States at the First Assembly, the Air Navigation Committee established tentative dates on which it would review the several Divisions' recommendations. These dates were communicated to all Contracting States in September 1947.

The First Assembly having adopted in Resolution A1-31 the definitions at the beginning of the Preamble, the Air Navigation Committee guided by those definitions reviewed and coordinated the Divisional Recommendations, taking account of the comments of Contracting States, of Regional Air Navigation Meetings and of the Secretariat. The International Standards and Recommended Practices, that the Council has adopted, accord as nearly as possible with the wording, phraseologies and format proposed by the Divisions.

As aviation develops, the Divisions will improve and add to the International Standards and Recommended Practices which today constitute considerable international agreement painstakingly reached after over three years of technical discussion. Improvements can only be made after Contracting States have had practical experience of applying principles common to all Contracting States. The texts of the International Standards and Recommended Practices provide such principles for incorporation into the Regulations and administrative practices of each Contracting State.

PREAMBLE

This document contains Standards and Recommended Practices pursuant to Article 37 of the Convention on International Civil Aviation (Chicago 1944). These Standards and Recommended Practices, adopted by the Council, become effective in accordance with the Resolution found in the paragraph entitled "Adoption of Annex".

DEFINITIONS

In order to ensure uniform interpretation of the terms "Standards" and "Recommended Practices", which are not specifically defined in the Convention, the Council has promulgated the following definitions which apply to this Annex:

Standards. Any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38.

Recommended practices. Any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention.

"Notes" which do not alter the meaning of the Standards and Recommended Practices have been included wherever it was necessary to clarify an intention, to stress a particular point or to indicate that a particular question is under study.

ADOPTION OF ANNEX

The Standards and Recommended Practices for the Airworthiness of Aircraft are an outcome of Article 37 of the Convention which provides (inter alia) that the "International Civil Aviation Organization shall adopt and amend from time to time, as may be necessary, international standards and recommended practices and procedures dealing with * * * the airworthiness of aircraft."

The purposes underlying the establishment of International Standards and Recommended Practices for the Airworthiness of Aircraft are:

(a) To ensure that all aircraft engaged in international air navigation are certificated and inspected according to uniform procedures, and

(b) To establish airworthiness categories of aircraft, which shall define a minimum level of airworthiness for each such category and shall be exclusive in that no Contracting State will classify an aircraft in an ICAO airworthiness category unless the aircraft meets the airworthiness standards governing that ICAO category.

Only one airworthiness category — namely, the Transport Category "A" for aeroplanes—is at present established in this Annex. Other ICAO airworthiness categories for aeroplanes, and ICAO airworthiness categories for aircraft other than aeroplanes will be added in the future, as required for the safe and orderly development of international civil aviation.

Contracting States are not at present under an obligation to issue certificates of airworthiness classifying aeroplanes in the ICAO Transport Category "A", since the use of ICAO Transport Category "A" aeroplanes is not mandatory for any type of operation. Any State may, however, do so if it so desires when the standards of this Annex are in force, provided that the aeroplane so certificated meets the standards of this Annex.

Transport Category "A" aeroplanes are primarily intended for international air services.

Standards and Recommended Practices governing the operation of aircraft engaged in scheduled international air services are established in Annex 6.

The Council, at the 11th Meeting of its Sixth Session held on March 1, 1949, adopted the following resolution:

Whereas Articles 37 and 54 (1) of the Convention on International Civil Aviation provide for the adoption of International standards and recommended practices (including procedures) and their designation as annexes; and

Whereas Article 90 provides for the procedure for adoption by the Council of the annexes referred to in Article 54 (1); for the submission thereof to Contracting States and for registration of disapproval thereof; and

Whereas the adoption of Standards of Airworthiness for categories of aircraft established by ICAO does not affect recognition by Contracting States of national certificates of airworthiness for aircraft not certificated in those categories; and

Whereas it is desirable that certain provisions of a general nature should be applicable to the certification of airworthiness of all aircraft at an early date; and

Whereas the Council has understood that the "differences" to be notified pursuant to Article 38 should cover non-compliance in any respect with an international standard and any difference between any practice or regulation of a State and the practice established by an international standard, on all those subjects in respect of which ICAO may adopt standards under Article 37;

Now, therefore,

The Council at a meeting called for the purpose hereby adopts on March 1, 1949, the international standards and recommended practices contained in the attached document entitled "Standards and Recommended Practices for the Airworthiness of Aircraft" and designates them as "Annex 8" to the Convention; and

The Council further resolves that:

(1) The above-mentioned Annex together with a copy of this resolution be submitted forthwith to each Contracting State;

(2) Any Contracting State may register with the Council not later than August 1, 1949, its disapproval of the said Annex or any part thereof;

(3) If on August 1, 1949, a majority of the Contracting States have not registered their disapproval of the said Annex, it shall then become effective;

(4) If any part or parts of the said Annex have been disapproved by a majority of the Contracting States on August 1, 1949, then only such parts thereof as have not been so disapproved shall become effective;

(5) In the event that any part or parts of the said Annex do not become effective by reason of such disapproval, they shall be deleted therefrom;

(6) The said Annex (in whole or in part, as hereinbefore provided) shall come into force and be implemented as follows:

(a) Paragraphs 1, 2, 4, 5, and 6 of Part II, on September 1, 1949, in respect of any aircraft provided with a certificate of airworthiness which does not classify such aircraft in an ICAO category of airworthiness;

(b) Parts I, II, and III on September 1, 1949, in respect of any aeroplane provided, or to be provided, with a certificate of airworthiness classifying such aeroplane in the ICAO Transport Category "A".

(7) The becoming effective of the said Annex shall forthwith be notified to each Contracting State, and each State shall also, at the same time, be notified:

(a) Of the said dates upon which the said Annex shall come into force;

(b) That each Contracting State is urged to apply paragraphs 3, 7, and 8 of Part II, as soon as practicable, in respect of any aircraft to be engaged in international air navigation;

(c) That, from September 1, 1949, the said Annex is to be regarded, for the purpose of Article 33 of the Convention, as defining the minimum standards established pursuant to the Convention, in respect of any aeroplane provided with a certificate of airworthiness classifying such aeroplane in the ICAO Transport Category "A";

(d) That each Contracting State which intends to issue certificates of airworthiness on or after September 1, 1949, in the ICAO Transport Category "A" for aeroplanes in accordance with this Annex, should notify the Organization of the date on which it has first issued such a certificate;

(e) That in respect of any aircraft provided with a certificate of airworthiness which does not classify it in a category established by ICAO, any difference as defined in the preamble hereto which exists on or after September 1, 1949, between any of its own practices and those established by the said international standards contained in paragraphs 1, 2, 4, 5, and 6 of Part II of the said Annex shall be immediately notified to the Organization.

LANGUAGE

The following is the text of a resolution adopted by the Council on April 13, 1948, at the 22d meeting of its third session, and modified on December 6, 1948, at the 25th meeting of its fifth session.

The Council resolves that:

(1) Annexes to the Convention on International Civil Aviation be adopted by the Council in English;

(2) The English text, so adopted, together with the texts in French and Spanish as prepared by the Secretariat, be transmitted by the Council to each Contracting State for the purpose hereinafter set forth;

(3) Each Contracting State be invited to notify the Organization, not later than the date set for registering disapproval of a particular Annex or any part thereof, of the text selected by that State as its official text for the purpose of national implementation (including translation into its own national language if necessary) of the said Annex or part thereof and for any other effects provided for in the Convention.

EDITORIAL NOTE

The following practice has been adhered to in order to indicate at a glance the status of each statement; Standards have been printed in large type; Recommended Practices have been printed in small type, the status being indicated by the prefix "Recommandation". Notes have been printed in small type, the status being indicated by the prefix "Note".

Throughout this Annex, measurements are given in metric units followed in parentheses by corresponding measurements in English units; where speeds are expressed in miles per hour, statute miles per hour are meant.

Any reference to a portion of this document, which is identified by a number, includes all subdivisions of such portion.

PART I—DEFINITIONS

NOTE: Part I was adopted by the Council on March 1, 1949; the Council resolved that it should come into force and be implemented on September 1, 1949, in respect of any aeroplane provided, or to be provided, with a certificate of airworthiness classifying such aeroplane in the ICAO Transport Category "A".

When the following terms are used in Part III of this Annex, they shall have the following meanings:

1. *General.*

Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Aeroplane configurations. Various combinations of the positions of the movable elements, such as wing flaps, landing gear, etc., which affect the aerodynamic characteristics of the aeroplane.

Critical engine(s). The engine(s), failure of which gives the most adverse effect on the aircraft characteristics relative to the case under consideration.

Critical point.

NOTE: This term refers to a point defined in Part III, 2.3.3.1, and used in the determination of the take-off performance of Transport Category "A" aeroplanes.

Fireproof. Fireproof material means a material capable of withstanding heat as well as, or better than, steel when the dimensions in both cases are appropriate for the specific purpose. When "fireproof" is applied to material and parts used to confine fires in designated fire zones "fireproof" means that the material or part will perform this function under the most severe conditions of fire, including duration, likely to occur in such zones.

Fire-resistant. When applied to sheet or structural members, "fire-resistant" material means a material capable of withstanding heat as well as, or better than, aluminum alloy when the dimensions in both cases are appropriate for the specific purpose. When applied to fluid carrying lines, fittings, and power-plant controls, "fire-resistant" means capable of performing the intended functions under the heat and other conditions likely to occur at the particular location.

Inflammable fluids or gases. Fluids or gases which will ignite readily or explode.

Maximum anticipated air temperatures.

NOTE: This term refers to the temperatures, defined in Part III, 7.2.6.1, which are specified for the purpose of compliance with power-plant cooling standards.

Standard atmosphere. An atmosphere defined as follows:

(a) The air is a perfect dry gas;

(b) The temperature at sea level is 15° C. (59° F.);

(c) The pressure at sea level is 760 millimetres (29.92 inches) of mercury (1013.3 millibars);

(d) The temperature gradient from sea level to the altitude at which the temperature becomes −56.5° C. (−69.7° F.) is −0.0065° C. per metre (−0.003566° F. per foot), and zero thereabove;

NOTE: The density ρ_0 at sea level under the above conditions is 0.12497 kg. sec.^{2}/m^4 (0.002378 lb. sec^2/ft^4).

2. *Weights.*

Maximum weight. (See Part III, 2.2.1.1.)

Minimum weight. (See Part III, 2.2.1.2.)

Weight empty.

NOTE: This term refers to the empty weight of the aeroplane defined in Part III, 2.2.4, and used in the determination of operating weights.

Design maximum weight. The maximum aeroplane weight used in structural design for flight load conditions. (See Part III, 3.1.1.)

Design minimum weight. The minimum aeroplane weight at which compliance is shown with the structural loading conditions. (See Part III, 3.1.1.)

Design take-off weight. The maximum aeroplane weight used in structural design for the taxying conditions, and for landing conditions at a reduced velocity of descent. (See Part III, 3.4.1.)

Design landing weight. The maximum aeroplane weight used in structural design for landing conditions at the maximum velocity of descent. (See Part III, 3.4.1.)

3. *Speeds.*

TAS: True airspeed. The speed of the aircraft relative to undisturbed air.

EAS: Equivalent airspeed: TAS $(\rho/\rho_0)^{1/2}$ where ρ is the density of the air in the conditions under consideration and ρ_0 is the density of the air at sea level in the Standard Atmosphere.

CAS: Calibrated airspeed. The pitot static airspeed indicator reading (the scale of the indicator having been corrected for the increase in impact pressure due to the effects of compressible flow without shock waves, i. e., assuming adiabatic compression), corrected for airspeed indicator system errors, i. e., pitot static position errors; CAS is equal to TAS in the Standard Atmosphere at sea level.

IAS: Indicated airspeed. The reading of the pitot static airspeed indicator as

installed in the aeroplane, without correction for airspeed indicator system errors. (See Part III, 8.2.1.4 and 9.2.2.)

V_A. The design maneuvering speed (EAS). (See Part III, 3.2.)

V_B. The design speed (EAS), for maximum gust intensity. (See Part III, 3.2.)

V_C. The design cruising speed (EAS). (See Part III, 3.2.)

V_D. The design diving speed (EAS). (See Part III, 3.2.)

V_{DF}. The demonstrated flight diving speed (CAS for flight standards, IAS for operating limitations). (See Part III, 2.5 and 9.2.2.1.)

V_F. The design flap speed (EAS). (See Part III, 3.2.)

V_{MC}. The minimum control speed (CAS), with any one engine inoperative. (See Part III, 2.4.1.1.)

V_{NE}. The never exceed speed (IAS). (See Part III, 9.2.2.1.)

V_{NO}. The normal operating limit speed (IAS). (See Part III, 9.2.2.2.)

V_{s_0}. A stalling speed or minimum steady flight speed with wing flaps in the landing position (CAS for flight standards, EAS for structural design standards). (See Part III, 2.3.2.4 and 3.2.)

V_{s_1}. A stalling speed or minimum steady flight speed (CAS for flight standards, EAS for structual design standards). (See Part III, 2.3.2.5 and 3.2.)

Take-off safety speed. (See Part III, 2.3.3.2.)

Maneuvering speed. (See Part III, 9.2.2.3.)

Wing flap extended speed. (See Part III, 9.2.2.4.)

Landing gear operating speed. (See Part III, 9.2.2.5.)

Landing gear extended speed. (See Part III, 9.2.2.6.)

4. *Structural.*

Limit load. The maximum load anticipated in normal conditions of operation.

Ultimate load. The limit load multiplied by the appropriate factor of safety.

Factor of safety. A design factor used to provide for the possibility of loads greater than those anticipated in normal conditions of operation, and for uncertainties in design.

Load factor. The ratio of a specified load to the weight of the aeroplane; the specified load may be expressed in terms of any of the following: aerodynamic forces, inertia forces, or ground or water reactions.

Maneuvering load factor. The total aerodynamic lift on the aeroplane, acting perpendicularly to the flight path, divided by the weight of the aeroplane.

NOTE: In straight steady level flight, this load factor is equal to unity.

Checked maneuver. (See Part III, 3.3.1.3.1.)

Design wing area. The area enclosed by the wing outline (including wing flaps in the retracted position and ailerons, but excluding fillets or fairings) on a surface containing the wing chords. The outline is assumed to be extended through the nacelles and fuselage to the plane of symmetry in any reasonable manner.

5. *Engines.*

Prototype engine. The first engine, of a type and arrangement not approved previously, to be submitted for type approval test.

Series engine. An engine essentially identical in design, in materials, and in methods of construction, with one which has been approved previously.

Modified engine. An engine, approved previously, in which modifications hitherto unapproved have been embodied.

Brake horsepower. The power delivered at the propeller shaft of the engine.

NOTE: Units of power:

Metric horsepower: 1 cv=75 kilogrammetres per second;

English horsepower: 1 hp=33,000 foot pounds per minute;

Power may also be expressed in kilowatts, and the relation between these units is:

1 hp=1.014 cv.
1 cv=0.736 kw.
1 hp=0.746 kw.

Take-off power rating. The brake horsepower developed under standard sea level conditions, under the maximum conditions of crankshaft rotational speed and engine manifold pressure approved for use in normal take-off, and limited in use to a continuous period not exceeding 5 minutes.

Maximum continuous power. The brake horsepower developed in Standard Atmosphere at a specified altitude under the maximum conditions of crankshaft rotational speed and engine manifold pressure approved for use during periods of unrestricted duration.

Maximum recommended cruising power. The brake horsepower developed in Standard Atmosphere under conditions of crankshaft rotational speed and engine manifold pressure, recommended in the Engine Instruction Manual as maxima for cruising operation at a specified altitude.

Maximum weak mixture power. The brake horsepower developed in Standard Atmosphere at a specified altitude, under the maximum conditions of crankshaft rotational speed and engine manifold pressure, for use during periods of unrestricted duration, with economical cruising mixture strength.

Manifold pressure. The absolute pressure measured at the appropriate point in the induction system.

Maximum engine overspeed. The maximum crankshaft rotational speed which has been determined under the most adverse conditions to have no detrimental effect on the engine when used for a period of 20 seconds.

Critical altitude. The maximum altitude at which in Standard Atmosphere, it is possible to maintain at a specified rotational speed without ram, a specified power or a specified manifold pressure.

Unless otherwise stated the critical altitude is the maximum altitude at which it is possible to maintain without ram, at the maximum continuous rotational speed, one of the following:

(a) The maximum continuous power, in the case of engines for which this power rating is the same at sea level or at the rated altitude;

(b) The maximum continuous rated manifold pressure, in the case of engines the maximum continuous power of which is governed by a constant manifold pressure.

6. *Propellers.*

Prototype propeller. The first propeller of a type and arrangement not approved previously, to be submitted for type approval test.

Series propeller. A propeller essentially identical in design, in materials, and in methods of construction, with one which has been approved previously.

Modified propeller. A propeller approved previously, in which modifications hitherto unapproved have been embodied.

Propeller accessories. All accessories used with, or necessary for, the control and operation of the propeller.

Fixed-pitch propeller. A propeller, the pitch setting of which cannot be changed except by processes constituting a work-shop operation.

Adjustable pitch propeller. A propeller, the pitch setting of which can be conveniently changed in the course of ordinary field maintenance, but which cannot be changed when the propeller is rotating.

Variable pitch propeller. A propeller, the pitch setting of which changes, or can be changed when the propeller is rotating.

This includes:

(a) A propeller, the pitch setting of which is directly under the control of the flight crew;

(b) A propeller, the pitch setting of which is controlled by a governor or other automatic means, which may be either integral with the propeller or a separately mounted accessory, and which may, or may not, be controlled by the flight crew;

(c) A propeller, the pitch setting of which may be controlled by a combination of (a) and (b).

Pitch setting. The propeller blade setting determined by the blade angle measured in a manner, and at a radius, specified in the Propeller Instruction Manual.

Feathered pitch. The pitch setting, specified in the Propeller Instruction Manual, which in flight with the engine stopped, gives approximately the minimum drag, and corresponds with a windmilling torque of approximately zero.

Maximum propeller overspeed. The maximum propeller rotational speed which has been determined to have no detrimental effect on the propeller when used for a period of 20 seconds.

Maximum propeller governed speed (variable pitch propellers). The maximum propeller rotational speed, as determined by the setting of the propeller governor or control mechanism.

PART II—ADMINISTRATION

NOTE: Part II was adopted by the Council on March 1, 1949; the Council resolved that it should come into force and be implemented on September 1, 1949 as follows:

(a) Paragraphs 1, 2, 4, 5, and 6 in respect of any aircraft provided with a certificate of airworthiness which does not classify such aircraft in an ICAO category of airworthiness;

(b) The whole of Part II in respect of any aeroplane provided, or to be provided, with a certificate of airworthiness classifying such aeroplane in the ICAO Transport Category "A".

1. *Definitions.*

INTRODUCTORY NOTE: Certificate of airworthiness, as used in these Standards, is the certificate of airworthiness referred to in Article 31 of the Convention.

When the following terms are used in the Standards and Recommended Practices for the Airworthiness of Aircraft, they shall have the following meanings:

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air.

Applicant. A person applying for approval of an aircraft or of any part thereof.

Approved. Accepted by a Contracting State as suitable for a particular purpose.

Rendering (a certificate of airworthiness) valid. The action taken by a Contracting State, as an alternative of issuing its own certificate of airworthiness, in accepting a certificate of airworthiness issued by any other Contracting State as the equivalent of its own certificate of airworthiness.

State of registry. The State on whose register the aircraft is entered.

2. *Airworthiness categories.*

2.1 A Contracting State shall not issue or render valid a certificate of airworthiness classifying an aircraft in an airworthiness category established by ICAO, unless the aircraft complies with the standards in force for that category or, in the circumstances of particular cases, with variations therefrom in detail, that the State may consider appropriate to give at least an equivalent level of safety.

NOTE: A Contracting State, when issuing or rendering valid a certificate of airworthiness which does not classify an aircraft in a category established by ICAO, may issue or render valid such certificate on the basis of compliance with whatever airworthiness requirements the State deems appropriate.

2.2 The term "the appropriate airworthiness requirements" as used in Part II shall mean:

(a) The appropriate ICAO Airworthiness Standards or the national airworthiness requirements enforcing such Standards, if the certificate of airworthiness classifies the aircraft in an airworthiness category established by ICAO;

(b) The national airworthiness requirements deemed appropriate by the State, if the certificate of airworthiness does not classify the aircraft in a category established by ICAO.

3. *Proof of compliance with appropriate airworthiness requirements.*

3.1 The certificate of airworthiness shall be issued by the Contracting State which approves the aircraft or by its authorized representatives on the basis of satisfactory evidence that the aircraft complies with the appropriate airworthiness requirements. Except when certificates of airworthiness are issued in accordance with 3.2, that State, or its authorized representatives, shall obtain such evidence in the manner prescribed in 3.1.1, 3.1.2, and 3.1.3.

3.1.1 There shall be an approved design consisting of such drawings, specifications, reports and documentary evidence as are necessary to show that the aircraft complies with the appropriate airworthiness requirements. Records shall be maintained to establish the identification of the aircraft with its approved design.

3.1.2 During the course of construction, the aircraft shall be inspected in accordance with a system of inspection approved by the State, to determine that it conforms in all essential respects with the approved design, and that its construction and assembly are satisfactory.

3.1.3 The aircraft shall be subjected to such flight tests as are deemed necessary by the State to show compliance with the appropriate airworthiness requirements.

3.2 When an aircraft possessing a valid certificate of airworthiness issued by a Contracting State is entered on the Register of another Contracting State, the new State of Registry, when issuing another certificate of airworthiness or rendering the original certificate valid, may consider prior issuance of the certificate or airworthiness by a Contracting State as satisfactory evidence that the aircraft is airworthy and need not follow the procedure prescribed in 3.1.1, 3.1.2 and 3.1.3; if the certificate of airworthiness classified the aircraft in an airworthiness category established by ICAO, the new State of Registry, when issuing another certificate of airworthiness or rendering the original certificate valid, may classify the aircraft in the same ICAO airworthiness category, without an obligation to require additional technical investigation.

NOTE: This applies both when the aircraft is registered for the first time and when the aircraft changes its nationality.

3.3 Contracting States, in addition to enforcing the standards governing the appropriate ICAO airworthiness category for an aircraft, shall take whatever other steps they deem necessary, such as the application of national amplifications of the standards governing that airworthiness category, to ensure that the certificate of airworthiness is withheld if the aircraft is known or suspected to have dangerous features not specifically guarded against by those standards.

4. *Continuing airworthiness of aircraft.*

4.1 *Determination of continuing airworthiness.* The continuing airworthiness of an aircraft shall be determined by the State of Registry in relation to the appropriate airworthiness requirements in force for that aircraft at the time of inspection.

NOTE: This applies both to normal inspections and to inspections after the aircraft has been damaged.

NOTE: The State of Registry may delegate its power of decision to another State, to a body or to a person.

4.2 *Information related to continuing airworthiness of aircraft.* Any Contracting State that has approved an aircraft as being airworthy shall transmit, upon request, to another Contracting State, any technical orders and specifications that, in the opinion of the former Contracting State, are necessary for the continuing airworthiness of that aircraft.

5. *Validity of certificate of airworthiness.* A certificate of airworthiness shall be renewed or shall remain valid, subject to the laws of the State of Registry, provided that the State of Registry shall require that the continuing airworthiness of the aircraft shall be determined either by periodical inspection at intervals not exceeding twelve months, or by a system of continuous inspection.

6. *Temporary invalidity of certificate of airworthiness.*

6.1 *General.* Any failure to maintain an aircraft in an airworthy condition as defined by the appropriate airworthiness requirements shall render the certificate of airworthiness invalid until the aircraft is restored to an airworthy condition.

6.2 *Damage to aircraft.* When an aircraft possessing a valid certificate of airworthiness has sustained damage, the State of Registry shall judge whether the damage is of a nature such that the aircraft is no longer airworthy as defined by the appropriate airworthiness requirements.

6.2.1 If the damage is sustained or ascertained when the aircraft is on the territory of another Contracting State, the authorities of the other Contracting State shall be entitled to prevent the aircraft from resuming its flight on the condition that they shall advise the State of Registry immediately, communicating to it all details necessary to formulate the judgment referred to in the introductory standard of 6.2.

6.2.2 When the State of Registry considers that the damage sustained is of a nature such that the aircraft is no longer airworthy, it shall suspend the certificate of airworthiness and prohibit the aircraft from resuming flight until it is restored to an airworthy condition; the State of Registry may, however, in exceptional circumstances, prescribe particular limiting conditions to permit the aircraft to fly without fare-paying passengers to an aerodrome at which it can be restored to an airworthy condition, and the Contracting State that had originally, in accordance with 6.2.1, prevented the aeroplane from resuming flight, shall permit such flight.

6.2.3 When the State of Registry considers that the damage sustained is of a nature such that the aircraft is still airworthy, the aircraft shall be allowed to resume its flight.

7. *Standard form of certificate of airworthiness.* The certificate of airworthiness shall be a replica of the following form in wording and arrangement. (The size of the form is at the discretion of the State.)

[1] [1]

State ______________________________
Ministry ____________________________
Department or Service ________________

CERTIFICATE OF AIRWORTHINESS

1. Nationality and registration marks ____
2. Manufacturer and manufacturer's designation of Aircraft ____________________
3. Aircraft Serial No. __________________
4. Categories [2] _______________________

[1] For use of State of Registry.

[2] Reference here to any one of the ICAO airworthiness categories can only be made if the aircraft complies with the Airworthiness Standards in force for such category (see 2.1).

5. This Certificate of Airworthiness is issued, pursuant to the Convention on International Civil Aviation dated December 7th, 1944 and[3] ____________________, in respect of the above-mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the foregoing and the pertinent ________________ Flight Manual.

Date of issue ____________________________

Signature ____________________________

6.[4]

[3] Insert reference to National Regulations.

[4] This space shall be used either for periodic endorsement (giving date of expiring), or for a statement that the aircraft is being maintained under a system of continuous inspection.

8. *Flight manual.* Each aircraft shall be provided with a flight manual associated with the certificate of airworthiness; such flight manual shall contain the limitations within which the aircraft is considered airworthy as defined by the appropriate airworthiness requirements, and additional instructions and information necessary for the safe operation of the aircraft.

Part III—Aeroplanes

Note: Part III was adopted by the Council on March 1, 1949; the Council resolved that it should come into force and be implemented on September 1, 1949, in respect of any aeroplane provided, or to be provided, with a certificate of airworthiness classifying such aeroplane in the ICAO Transport Category "A".

Chapter 1—Aeroplane Categories

The standards in Part III shall govern the issuance and rendering valid of ICAO Transport Category "A" certificates of airworthiness for aeroplanes (see Part II, par. 2). ICAO Transport Category "A" aeroplanes shall have two or more engines.

Note 1: Aeroplanes with ICAO Transport Category "A" certificates of airworthiness are primarily intended for the carriage of persons for remuneration or hire in international air services.

Note 2: Airworthiness standards for ICAO categories of aeroplanes other than the ICAO Transport Category "A" will be developed at a later date.

Chapter 2—Flight

2.1 *Policy regarding proof of compliance.* Compliance with the standards prescribed in Chapter 2 shall be established by flight or other tests conducted upon an aeroplane of the type for which a certificate of airworthiness is sought, or by calculations based on such tests, provided that the results obtained by calculations are equal in accuracy to the results of direct testing.

Compliance with each standard shall be established at all combinations of aeroplane weight and center of gravity position, within the range of loading conditions for which certification is sought, by systematic investigation of all these combinations, except where compliance can be inferred reasonably for certain of the combinations, from the combinations which are investigated.

Where the prescribed configuration of an aeroplane is not appropriate to a particular type of practicable configuration, as near as possible to that prescribed, shall be substituted, unless precluded by a particular standard.

2.2 *Weight and center of gravity limitations.* Limits of aeroplane weight and center of gravity position shall be established either as limits for all operating conditions or as limits for each practicably separable operating condition (e. g., take-off, en route, landing), by showing compliance with the standards applicable to such operating condition(s).

2.2.1 *Weight limitations.* The maximum and minimum weights at which the aeroplane will be suitable for operation shall be established.

2.2.1.1 *Maximum weight(s).* Maximum weight(s) shall not exceed any of the following:

(a) The relevant weight selected by the applicant;

(b) The relevant design weight for which the structure has been proven;

(c) The maximum weight at which compliance with all the applicable flight standards has been demonstrated.

2.2.1.2 *Minimum weight(s).* Minimum weight(s) shall not be less than any of the following:

(a) The relevant minimum weight selected by the applicant;

(b) The design minimum weight for which the structure has been proven;

(c) The minimum weight at which compliance with all the applicable flight standards has been demonstrated.

2.2.2 *Center of gravity limitations.* Center of gravity limits shall be established as the most forward position permissible for each weight established in accordance with 2.2.1 and the most aft position permissible for each of such weights.

Such limits of the center of gravity range shall not exceed any of the following:

(a) The extremes selected by the applicant;

(b) The extremes for which the structure has been proven;

(c) The extremes at which compliance with all the applicable flight standards has been demonstrated.

2.2.3 *Additional limitations on weight distribution.* If a weight and center of gravity combination is permissible only within certain load distribution limits (e.g., spanwise), which could inadvertently be exceeded, such limits shall be established together with the corresponding weight and center of gravity combinations, and shall not exceed any of the following:

(a) The limits selected by the applicant;

(b) The limits for which the structure has been proven;

(c) The limits for which compliance with all the applicable flight standards has been demonstrated.

2.2.4 *Weight empty.* The weight empty, and the corresponding center of gravity position, shall be determined by weighing the aeroplane. This weight shall exclude the weight of the crew and payload, but shall include the weight of all fixed ballast, unusable fuel supply, undrainable oil, total quantity of engine coolant, and total quantity of hydraulic fluid.

The condition of the aeroplane at the time of weighing shall be one which can be easily repeated and easily defined, particularly as regards the contents of the fuel, oil and coolant tanks, and the items of equipment installed. This condition at the time of weighing shall be defined and recorded in the Aeroplane Flight Manual, together with the aeroplane weight empty.

2.3 *Performance.*

2.3.1 *General.* The following performances shall be determined and the aeroplane shall comply with the corresponding standards; unless otherwise specified the conditions shall be: Standard Atmosphere and still air.

The wing flap positions for take-off, approach, and landing, as well as those for en route, used for showing compliance with the performance standards, shall be selected by the applicant.

Note: The positions may be made variable with weight and altitude.

2.3.2 *Stalling speed; minimum steady flight speed.*

2.3.2.1 *Definition of stalling speed.* For the purpose of these Standards the stalling speed is the speed at which a large amplitude pitching or rolling motion, not immediately controllable, is encountered when the maneuver described in 2.3.2.3 is executed.

Note: An uncontrollable pitching motion of small amplitude associated with pre-stall buffeting, does not necessarily indicate that the stalling speed has been reached.

2.3.2.2 *Definition of minimum steady flight speed.* The minimum steady flight speed is that obtained while maintaining the elevator control in the most rearward possible position when the maneuver described in 2.3.2.3 is executed.

Note: This speed does not apply when the stalling speed defined in 2.3.2.1 occurs before the elevator control reaches its stops.

2.3.2.3 *Determination of stalling speed; minimum steady flight speed.* The aeroplane shall be trimmed for a speed approximating to $1.4V_{s_1}$. From a value sufficiently above the stalling speed to ensure that a steady rate of decrease is obtainable, the speed shall be reduced in straight flight at a rate not exceeding 1.5 kilometers (1 mile) per hour per second until the stalling speed or the minimum steady flight speed, defined in 2.3.2.1 and 2.3.2.2, is reached.

Note: For the purpose of measuring stalling speed and minimum steady flight speed, the instrumentation will need to be such that the probable error of measurement is known.

Recommendation: The probable error should be comparable with that obtained with a conventional aeroplane, when the stalling speed is measured by means of an airspeed indicator connected to an efficient swivelling pitot head and a trailing static head, and an average of three readings is taken.

2.3.2.4 V_{s_0}. V_{s_0} denotes the measured stalling speed if obtainable, or the minimum steady flight speed, in kilometers (miles) per hour, CAS, with:

(a) Engines idling, either with throttles closed, or at not more than sufficient power for zero thrust at a speed not greater than 110% of the stalling speed;

(b) Propeller pitch controls in the position recommended by the applicant for normal use during take-off;

(c) Landing gear extended;

(d) Wing flaps in the appropriate landing position as prescribed in the standards in which V_{s_0} is the basis for specification;

(e) Cowl flaps and radiator shutters closed or nearly closed;

(f) Center of gravity in that position within the permissible landing range which gives the maximum value of stalling speed or of minimum steady flight speed;

(g) Aeroplane weight equal to the weight involved in the standard under consideration.

2.3.2.5 V_{s_1}. V_{s_1} denotes the measured stalling speed if obtainable, or the minimum steady flight speed in kilometers (miles) per hour, CAS, with:

(a) Engines idling, either with throttles closed, or at not more than sufficient power for zero thrust at a speed not greater than 110% of the stalling speed;

(b) Propeller pitch controls in the position recommended by the applicant for normal use during take-off;

(c) Aeroplane in the configuration in all other respects and at the weight prescribed in the standard under consideration.

2.3.3 *Take-off.* The take-off data defined in 2.3.3.1, 2.3.3.2, 2.3.3.3 and 2.3.3.4 shall be determined with the operating engines not exceeding their approved limitations:

(a) For the following conditions:

(i) Sea level;

(ii) Aeroplane weight equal to the maximum take-off weight at sea level;

(iii) Level, smooth, dry and hard take-off surface (landplanes); smooth water of declared density (seaplanes);

(b) Over such ranges of the following variables as the applicant may desire:

(i) Atmospheric conditions, namely:

Altitude (in the standard atmosphere) and also

Altitude (defined by pressure in the standard atmosphere) and temperature (other than that in the standard atmosphere);

(ii) Aeroplane weight;

(iii) Steady wind velocity parallel to the direction of take-off;

(iv) Uniform take-off surface gradient (landplanes);

(v) Nature of take-off surface (landplanes); water surface condition (seaplanes);

(vi) Density of water and strength of current (seaplanes).

All take-off performance shall be determined in a manner such that its repetition does not require exceptional skill or alertness on the part of the pilot.

The methods of correcting the performance data to obtain data for adverse atmospheric conditions shall include appropriate allowance for any increased airspeeds, and cowl flap or radiator shutter openings, necessary under such conditions to maintain engine temperatures within appropriate limits.

NOTE: Appropriate interpretations of the term "landing gear", etc., are to be made for seaplanes to provide for the operation of retractable floats, if employed.

RECOMMENDATION: For skiplanes the coefficient of sliding friction between the snow and the skis for the conditions for which the take-off performance has been determined should be recorded in the Aeroplane Flight Manual.

2.3.3.1 *Critical point.* The critical point is a point selected by the applicant, at which, for the purpose of determining the accelerate stop distance and the take-off path, failure of the critical engine is assumed to occur.

NOTE: The Critical Point may be before or after the point at which the Take-off Safety Speed is reached.

The pilot shall be provided with a ready and reliable means of determining when the critical point has been reached.

If the critical point is located so that the air-speed at that point is less than the Take-off Safety Speed, it shall be demonstrated that, in the event of sudden failure of the critical engine at all speeds down to the lowest speed corresponding with the critical point, the aeroplane is controllable satisfactorily and that the take-off can be continued safely, using normal piloting skill, without:

(a) Reducing the thrust of the remaining engines, except insofar as this can be done completely automatically as an engine fails;

(b) Encountering characteristics which would result in unsatisfactory controllability on wet runways.

2.3.3.2 *Take-off safety speed.* The take-off safety speed is an airspeed (CAS) selected by the applicant, at which the aeroplane shall be able to achieve the rates of climb prescribed in 2.3.4.2.1 when the weight and configurations are as prescribed in 2.3.4.2.1, but which shall not be less than:

(a) $1.20V_{s_1}$ for aeroplanes with two engines;

(b) $1.15V_{s_1}$ for aeroplanes having more than two engines;

(c) 1.10 times the minimum control speed, V_{MC}, established as prescribed in 2.4.1.1.

2.3.3.3 *Accelerate stop distance.* The accelerate stop distance is the distance required to reach the critical point from a standing start, and, assuming the critical engine to fail suddenly at this point, to stop if a landplane, or to bring the aeroplane to a speed of approximately 5 kilometres (3 miles) per hour if a seaplane.

In addition to, or in lieu of, wheel brakes, other reliable braking means may be used in determining this distance, provided that the manner of their employment is such that consistent results can be expected under normal conditions of operation, and that exceptional skill is not required to control the aeroplane.

The landing gear shall remain extended throughout this distance.

2.3.3.4 *Take-off path.* The take-off path shall be determined either by the method of 2.3.3.4.1 or of 2.3.3.4.2.

2.3.3.4.1 *Method of elements.*

NOTE: In (a) the take-off safety speed point is the point at which the take-off safety speed is first attained.

In order to define the take-off path, the following elements shall be determined (see fig. 2–1):

(a) The distance required to accelerate the aeroplane from a standing start to the take-off safety speed point, subject to the following provisions:

(i) If the critical point is located before the take-off safety speed point, the critical engine shall be made inoperative at the critical point;

(ii) If the critical point is located after the take-off safety speed point, a determination shall also be made of the distance traversed and the height attained by the aeroplane in steady flight at the take-off safety speed, between the take-off safety speed point and the critical point;

(iii) The aeroplane shall remain on or close to the ground up to the take-off safety speed point, and the landing gear shall remain extended up to the critical point or take-off safety speed point, whichever is reached later.

(b) The horizontal distance traversed and the height attained by the aeroplane, operating at the take-off safety speed, during the time required to retract the landing gear, retraction being initiated at the end of (a), with:

(i) The critical engine inoperative, its propeller windmilling, and the propeller pitch control in the position recommended by the applicant for normal use during take-off; except that if the completion of the retraction of the landing gear occurs later than the completion of the stopping of the propeller initiated in accordance with (c) (i), the propeller may be assumed to be stopped throughout the remainder of the time required to retract the landing gear;

(ii) The landing gear extended.

(c) When the completion of the retraction of the landing gear occurs earlier than the completion of the stopping of the propeller, the horizontal distance traversed and the height attained by the aeroplane in the time elapsed from the end of (b) until the rotation of the inoperative propeller has been stopped, when:

(i) The operation of stopping the propeller is initiated not earlier than the instant the aeroplane has attained a total height of 15 metres (50 feet) above the take-off surface;

(ii) The aeroplane speed is equal to the take-off safety speed;

(iii) The landing gear is retracted;

(iv) The inoperative propeller is windmilling with the propeller pitch control in the position recommended by the applicant for normal use during take-off.

(d) The horizontal distance traversed and the height attained by the aeroplane in the time elapsed from the end of (c) until the time limit on the use of take-off power is reached, while operating at the take-off safety speed, with:

(i) The inoperative propeller stopped;

(ii) The landing gear retracted.

The elapsed time from the start of the take-off need not extend beyond a total of five minutes.

(e) The slope of the flight path with the aeroplane in the configuration prescribed in (d) and with the remaining engine(s) operating within the maximum continuous power limitations, where the time limit on the use of take-off power is less than five minutes.

NOTE: If satisfactory data are available, the true drag of the propeller and landing gear may be assumed during the appropriate portions of the elements.

During the take-off and subsequent climb represented by the elements, the wing flap control setting shall not be changed, except that changes made before the critical point has been reached, and not earlier than one minute after the critical point has been passed are acceptable. In this case, it shall be demonstrated that such changes can be accomplished without undue skill, concentration or effort on the part of the pilot (see 2.3.4.2.1 for prescribed climb with wing flaps in take-off position).

2.3.3.4.2 *Continuous method.* The take-off path shall be determined from an actual take-off, during which:

(a) The critical engine shall be made inoperative at the critical point;

(b) The climb-away shall not be initiated until the take-off safety speed has been reached, and the airspeed shall not fall below this value in the subsequent climb;

(c) Retraction of the landing gear shall not be initiated before the aeroplane reaches the critical point or the take-off safety speed, whichever occurs later;

(d) The wing flap control setting shall not be changed; except that changes made before the critical point has been reached, and not earlier than one minute after the critical point has been passed are acceptable; in this case, it shall be demonstrated that such changes can be accomplished without undue skill, concentration, or effort, on the part of the pilot;

(e) The operation of stopping the propeller shall not be initiated until the aeroplane has cleared a point 15 meters (50 feet) above the take-off surface.

Suitable methods shall be provided and employed to take into account and to correct for any vertical gradient of wind velocity which may exist during the take-off.

2.3.4 *Climb.* In addition to determining the climb performance for the standard atmosphere, the climb performance shall be determined over such ranges of temperatures as the applicant may desire.

NOTE: These standards may not provide an adequate gradient of climb for aeroplanes in which the propulsion means is such that the power available increases at an appreciably greater rate with aeroplane speed than is normally the case with a reciprocating engine/propeller combination.

2.3.4.1 *All engines operating.*

2.3.4.1.1 *En route.* The steady rate of climb at 1,500 meters (5,000 feet) shall be not less than an approved minimum, with:

(a) Engines operating within the maximum continuous power limitations;

(b) Landing gear retracted;

(c) Wing flaps in the most favorable position;

(d) Cowl flaps and radiator shutters in the position which provides adequate cooling under the maximum anticipated air temperatures as defined in 7.2.6.1;

(e) Aeroplane weight equal to the maximum take-off weight at sea level.

RECOMMENDATION: The approved minimum should be:

$1.73\frac{V_{s_1}}{100}$ meters per second ($5.5V_{s_1}$ feet per minute), V_{s_1} being expressed in kilometers (miles) per hour (see fig. 2-2).

The corresponding steady rate of climb at all altitudes, up to the maximum operating altitude (see 9.2.3), at which operation is practicable and at all weights within the range for which certification is sought, shall be determined and entered in the Aeroplane Flight Manual.

2.3.4.1.2 *Balked landing.* At each altitude within the range for which a maximum landing weight is to be established, the steady rate of climb shall be not less than an approved minimum, with:

(a) Engines operating within the take-off power limitations;

(b) Landing gear extended;

(c) Wing flaps in the appropriate landing position except that another position may be used provided that:

(i) The flaps are retracted from the appropriate landing position to that position by completely automatic means as power is applied; and

(ii) Such retraction does not involve dangerous change of trim, sudden change of angle of attack, or adverse change in the flight path; and

(iii) The time required to complete such retraction is not more than three seconds, or than the time required to increase the power of the engines safely from windmilling conditions to maximum take-off power, whichever is the greater;

if automatic wing flap retraction is provided, compliance with the conditions prescribed in (ii) and (iii) shall be demonstrated for all speeds between $1.2V_{s_0}$ and the maximum permissible speed with the wing flaps in the landing position;

(d) Cowl flaps and radiator shutters in the position recommended by the applicant for normal use in a final approach to a landing;

(e) Aeroplane weight equal to the maximum landing weight appropriate to the altitude.

RECOMMENDATION: The approved minimum should be the greater of: One meter per second or $1.375\left(\frac{V_{s_0}}{100}\right)^2$ meters per second (200 feet per minute or $0.07\ V_{s_0}^2$ feet per minute), V_{s_0} being expressed in kilometers (miles) per hour (see fig. 2-3).

2.3.4.2 *One engine inoperative.*

2.3.4.2.1 *Take-off.*

2.3.4.2.1.1 *Landing gear retracted.* At each altitude within the range for which a maximum take-off weight is to be established, the steady rate of climb shall be not less than an approved minimum, with:

(a) The inoperative propeller in that position which it would immediately take up in the event of engine failure, when the control is left in the position recommended by the applicant for normal use during take-off;

(b) Remaining engines operating within the take-off power limitations;

(c) Landing gear retracted;

(d) Wing flaps in the appropriate take-off position, corresponding with the wing flap control setting at the critical point (see 2.3.3.4.1 final paragraph and 2.3.3.4.2 (d));

(e) Cowl flaps and radiator shutters in the position recommended by the applicant for normal use during take-off;

(f) Aeroplane weight equal to the maximum take-off weight appropriate to the altitude;

(g) Airspeed equal to the take-off safety speed, defined in 2.3.3.2.

RECOMMENDATION: The approved minimum should be the lesser of:

$0.69\left(\frac{V_{s_1}}{100}\right)^2$ or $0.95\left(\frac{V_{s_1}}{100}\right)^{1.5}$ meters per second ($0.035\ V_{s_1}^2$ or $0.38\ V_{s_1}^{1.5}$ feet per minute), V_{s_1} being expressed in kilometers (miles) per hour (see fig. 2-4).

2.3.4.2.1.2 *Landing gear extended.* In the conditions of 2.3.4.2.1.1, but with the landing gear extended, the rate of climb when determined at a height such that ground effect is negligible shall be not less than an approved minimum.

RECOMMENDATION: The approved minimum should be 0.25 meter per second (50 feet per minute).

2.3.4.2.2 *En route.* The steady rate of climb at 1,500 meters (5,000 feet) shall be not less than an approved minimum, with:

(a) Critical engine inoperative, its propeller stopped;

(b) Remaining engines operating within the maximum continuous power limitations;

(c) Landing gear retracted;

(d) Wing flaps in the most favorable position;

(e) Cowl flaps and radiator shutters in the position which provides adequate cooling under the maximum anticipated air temperatures as defined in 7.2.6.1;

(f) Aeroplane weight equal to the maximum take-off weight at sea level.

RECOMMENDATION: For aeroplanes having a stalling speed V_{s_0} less than 193 kilometers (120 miles) an hour, the approved minimum should be not less in meters per second (feet per minute) than:

$$K\left(\frac{V_{s_0}}{100}\right)^2$$

(See fig. 2-5b), where V_{s_0} is expressed in kilometers (miles) per hour and K (see fig. 2-5a) has the following values:

TABLE 2-I—VALUES OF K

Maximum sea level take-off weight W	K (metric)	K (English)
18,140 kilograms (40,000 pounds) or less	0.391	200
18,140 kilograms (40,000 pounds) to 27,210 kilograms (60,000 pounds)	$0.391\times\frac{W-9{,}070}{9{,}070}$	$200\times\frac{W-20{,}000}{20{,}000}$
27,210 kilograms (60,000 pounds) or more	0.783	400

The corresponding steady rate of climb over the range of altitudes within which operation is permitted and practicable with one engine inoperative at all weights within the range for which certification is sought, shall be determined and entered in the Aeroplane Flight Manual.

2.3.4.2.3 *Approach.* At each altitude within the range for which a maximum landing weight is to be established, the steady rate of climb shall be not less than an approved minimum, with:

(a) Critical engine inoperative, its propeller stopped;

(b) Remaining engines operating within the take-off power limitations;

(c) Landing gear retracted;

(d) Wing flaps in the position recommended by the applicant for a preliminary approach with the critical engine inoperative;

(e) Cowl flaps and radiator shutters in the position recommended by the applicant for normal use during a preliminary approach to a landing;

(f) Aeroplane weight equal to the maximum landing weight appropriate to the altitude.

RECOMMENDATION No. 1: The approved minimum should be:

$0.69\left(\frac{V_{s_1}}{100}\right)^2$ meters per second ($0.035V_{s_1}{}^2$ feet per minute),

V_{s_1} being expressed in kilometers (miles) per hour (see fig. 2–6).

RECOMMENDATION No. 2: The approach position of the wing flaps should be such that V_{s_1} does not exceed 1.06 times the corresponding values of V_{s_0}.

NOTE: The main purpose of 2.3.4.2 above is to ensure to the greatest practicable extent that in the event of engine failure, the aeroplane will be able to maintain the altitude required to clear all obstacles and to reach a suitable landing area, thus minimizing the possibility of, and hazards associated with, an emergency landing.

2.3.4.3 *Two engines inoperative.* For aeroplanes with four or more engines, the steady rate of climb, over the range of altitudes within which operation is permitted and practicable with two engines inoperative, at all weights within the range for which certification is sought, shall be determined and entered in the Aeroplane Flight Manual, with:

(a) Two critical engines inoperative on one side of the aeroplane and their propellers stopped;

(b) Remaining engines operating within the maximum continuous power limitations;

(c) Landing gear retracted;

(d) Wing flaps in the most favourable position;

(e) Cowl flaps and radiator shutters in the position which provides adequate cooling under the maximum anticipated air temperatures as defined in 7.2.6.1.

2.3.5 *Landing.* The landing distance is the horizontal distance between that point on the landing surface at which the aeroplane is brought to a complete stop or, for seaplanes, to a speed of approximately 5 kilometers (3 miles) per hour and that point on the landing surface which the aeroplane cleared by 15 meters (50 feet).

The landing distance shall be determined: (a) For the following conditions:

(i) Sea level;

(ii) Aeroplane weight equal to the maximum landing weight at sea level;

(iii) Level, smooth, dry and hard landing surfaces (landplanes); smooth water of declared density (seaplanes);

(b) Over such ranges of the following variables as the applicant may desire:

(i) Atmospheric conditions, namely:

Altitude (in the standard atmosphere) and also

Altitude (defined by pressure in the standard atmosphere) and temperature (other than that in the standard atmosphere);

(ii) Aeroplane weight;

(iii) Steady wind velocity parallel to the direction of landing;

(iv) Uniform landing surface gradient (landplanes);

(v) Nature of landing surface (landplanes); water surface condition (seaplanes);

(vi) Density of water and strength of current (seaplanes).

RECOMMENDATION: For skiplanes the coefficient of sliding friction between the snow and the skis for the conditions for which the landing distance has been determined, should be recorded in the Aeroplane Fight Manual and should not exceed 0.15.

2.3.5.1 *Landing technique.* In determining the landing distance:

(a) Immediately before reaching the 15 meter (50 foot) height, a steady approach shall have been maintained, landing gear fully extended, with an airspeed of at least $1.3V_{s_0}$;

(b) The nose of the aeroplane shall not be depressed in flight nor the forward thrust increased by application of engine power after reaching the 15 meter (50 foot) height;

(c) The wing flap control shall be set in the landing position, and shall remain constant during the final approach, flare out and touch down, and on the landing surface at airspeeds above $0.9V_{s_0}$. When the aeroplane is on the landing surface, and the airspeed has fallen to less than $0.9V_{s_0}$, change of the wing flap control setting is acceptable;

(d) The landing shall be made in a manner such that there is no excessive vertical acceleration, no excessive tendency to bounce, and no display of any of the defects listed in 2.6.1, 2.6.2 and 2.7.1, and such that its repetition does not require either an exceptional degree of skill on the part of the pilot, or exceptionally favorable conditions;

(e) Wheel brakes shall not be used in a manner such as to produce excessive wear of brakes or tires, and the operating pressures on the braking system shall not be in excess of those approved.

In addition to, or in lieu of, wheel brakes, other reliable braking means may be used in determining the landing distance, provided that the manner of their employment is such that consistent results can be expected under normal conditions of operation and that exceptional skill is not required to control the aeroplane.

The gradient of the steady approach, and the details of the technique used in determining the landing distance, together with such variations in the technique as are recommended by the applicant for landing with the critical engine inoperative and any appreciable variation in landing distance resulting therefrom, shall be entered in the Aeroplane Flight Manual.

2.4 *Flying qualities.* The aeroplane shall comply with the standards of 2.4 at all altitudes up to the maximum anticipated operating altitude relevant to the particular standard. If, however, an aeroplane is found to have unsafe flying characteristics under any operating conditions likely to be encountered, it shall not be certificated, even if it complies literally with the text of these standards.

For the purpose of 2.4, the term "landing gear extended" shall mean, in the case of seaplanes, that all retractable floats or sponsons shall be in the "extended position" and the term "landing gear retracted" shall mean that all retractable floats or sponsons shall be in the "retracted position".

2.4.1 *Controllability.* The aeroplane shall be controllable safely and maneuverable during take-off, climb, level flight, all conditions of descent, and landing.

It shall be possible to make smooth transitions from one flight condition to another (e. g., turns, sideslips, changes of engine power, and changes of aeroplane configuration).

Such transitions shall not require exceptional skill, alertness, or strength, on the part of the pilot, and shall not introduce any danger of exceeding the limit load factor either under any normally expected operating conditions, or in the event of sudden failure of any engine.

2.4.1.1 *Minimum control speed,* V_{MC}. The minimum control speed shall be determined and shall not exceed a speed equal to $1.3V_{s_1}$, with:

(a) Maximum take-off power on all engines;

(b) Landing gear retracted;

(c) Wing flaps in take-off position;

(d) Cowl flaps and radiator shutters in the position recommended by the applicant for normal use during take-off;

(e) Aeroplane weight equal to the maximum sea level take-off weight;

(f) Aeroplane trimmed for take-off;

(g) Aeroplane airborne and ground effect negligible.

The minimum control speed shall be such that when any one engine is made inoperative at that speed, it shall be possible to recover control of the areoplane, with the one engine still inoperative, and to maintain the aeroplane in straight flight, at that speed, either with zero yaw, or (at the option of the applicant) with a bank not in excess of 5 degrees.

From the time at which the engine is made inoperative to the time at which recovery is complete, it shall not require exceptional skill, alertness, or strength, on the part of the pilot, to prevent any loss of altitude or any change of heading in excess of 20 degrees, nor shall the aeroplane assume any dangerous attitude.

It shall be demonstrated that to maintain the aeroplane in steady straight flight at this speed, after recovery and

before retrimming, does not require a control force exceeding 81.5 kilograms (180 pounds) and does not make it necessary for the flight crew to reduce the power of the remaining engines.

2.4.1.2 *Longitudinal control.*

2.4.1.2.1 *Criterion 1.* It shall be possible, at all speeds between $1.4V_{s_1}$ and the stall, to pitch the aeroplane nose downwards so that a speed equal to $1.4V_{s_1}$ can be reached promptly with:

(a) Power off and maximum continuous power on all engines;

(b) Landing gear extended;

(c) Wing flaps both retracted and extended;

(d) Aeroplane trimmed for a speed equal to $1.4V_{s_1}$.

2.4.1.2.2 *Criterion 2.* It shall be possible to execute the manoeuvres in (a) and (b) herein, both with the landing gear retracted and with the landing gear extended, without involving a change in the trim control setting, or the exertion of more control force than can readily be applied by one hand for a short period.

(a) While maintaining an appropriate approach speed approximately of 1.3 to 1.4 times the value of V_{s_1} corresponding with the instantaneous position of the wing flaps and the aeroplane trimmed for the initial conditions:

(i) With power off and wing flaps retracted, extend the wing flaps as rapidly as possible;

(ii) With power off and wing flaps extended, retract the wing flaps as rapidly as possible;

(iii) At maximum take-off power and wing flaps extended, retract the wing flaps as rapidly as possible;

(iv) With power off and wing flaps retracted, apply maximum take-off power as rapidly as is practicable;

(v) With power off and wing flaps in sea level landing position, apply maximum take-off power as rapidly as is practicable.

(b) With power off, wing flaps in sea level landing position, and the aeroplane trimmed for a speed equal to $1.4V_{s_1}$, obtain and maintain both

(i) $1.1V_{s_1}$, and

(ii) $1.6V_{s_1}$.

The terms "extend" and "retract" shall be taken to mean that the wing flaps are moved from one extreme flight position to the opposite extreme flight position, except that movements over portions of the full range are acceptable if each portion is tested as prescribed herein, and if not more than three portions cover the entire range of wing flap positions used in flight, and also if the wing flap control is such that these intermediate positions cannot be passed through without at least two distinct actions on the part of the crew member operating the control.

2.4.1.2.3 *Criterion 3.* It shall not require exceptional skill on the part of the pilot to prevent any loss of altitude when wing flap retraction from any position is initiated during steady straight level flight at a speed equal to $1.1V_{s_1}$, with simultaneous application of not more than maximum take-off power, and with:

(a) Landing gear extended;

(b) Aeroplane weight equal to the maximum sea level landing weight.

2.4.1.3 *Lateral and directional control.*

2.4.1.3.1 *Criterion 1.* It shall be possible from initial conditions of steady straight flight at a speed equal to $1.4V_{s_1}$ to execute 15 degree banked turns, both with and against the inoperative engine, with:

(a) Critical engine inoperative and its propeller stopped;

(b) Remaining engines operating at maximum continuous power;

(c) Landing gear both retracted and extended;

(d) Wing flaps in the position most favourable for climb;

(e) Aeroplane weight equal to the maximum take-off weight.

2.4.1.3.2 *Criterion 2.* It shall be possible, while maintaining the aeroplane laterally level within 5 degrees, to yaw suddenly and to recover in either direction without encountering dangerous characteristics such as control overbalance or sudden loss of altitude.

This shall be demonstrated at a speed equal to $1.4V_{s_1}$, up to changes of heading of 15 degrees, except that the change of heading at which the rudder pedal force is 81.5 kilograms (180 pounds) need not be exceeded, with:

(a) Critical engine inoperative and its propeller stopped;

(b) Engine power required to maintain level flight at a speed equal to $1.4V_{s_1}$;

(c) Landing gear retracted;

(d) Wing flaps in the maximum sea level approach position;

(e) Aeroplane weight equal to the maximum sea level landing weight.

2.4.1.3.3 *Two engines inoperative.* For aeroplanes with four or more engines, a technique shall be established and entered in the Aeroplane Flight Manual for adequate control and safe handling of the aeroplane, in cruising flight and in landing, with the two critical engines inoperative. The technique established for cruising flight shall permit the realization of the performance established in accordance with 2.3.4.3.

2.4.2 *Trim.* In these Standards "trimming" is defined as the reduction to zero of the mean control forces needed to maintain straight flight at a given speed, without the aid of an automatic pilot.

It shall be possible to trim the aeroplane in conditions of loading, configuration, speed, and power, such as will ensure that the pilot will not be unduly fatigued or distracted (particularly under instrument flight conditions) by the effort otherwise required to maintain those conditions. This applies both in normal operation, and in the conditions associated with the failure of one or more engines for which performance characteristics are established.

Unless other conditions, providing an equivalent level of safety, are found to be appropriate, the ability to trim under the most adverse loadings of the aeroplane shall be demonstrated at least under the following conditions:

2.4.2.1 *All engines operating.* (a) Longitudinal trim, in

(i) Climb with maximum continuous power at a speed not in excess of $1.4V_{s_1}$, with the landing gear retracted and the wing flaps both retracted and in the take-off position;

(ii) Glide with power off, at a speed not in excess of $1.4V_{s_1}$, at all aeroplane weights approved for landing, with the center of gravity in the most forward position approved for each weight, with the landing gear extended and the wing flaps both retracted and extended;

(iii) Level flight with the wing flaps retracted and the landing gear extended, at all speeds between $1.4V_{s_1}$, and either the Landing Gear Operating Speed, or approximately 90% of the maximum speed in level flight at maximum continuous power with the landing gear extended, whichever is the lesser;

(iv) Level flight, with the wing flaps and landing gear retracted, at all speeds between $1.4V_{s_1}$ and either V_{NO} or 90% of the maximum speed in level flight at maximum continuous power, whichever is the lesser;

(v) Landing, approach, climb and cruising conditions as prescribed in 2.4.3.1.1 (a) to (e) inclusive.

(b) Lateral and directional trim for the most adverse lateral displacement of the centre of gravity within the relevant operating limitations, under all normally expected conditions of operation, including operation at any speed between $1.4V_{s_1}$ and either V_{NO} or 90% of the maximum speed in level flight at maximum continuous power, whichever is the lesser.

2.4.2.2 *Any one engine inoperative.* Longitudinal, lateral and directional trim, in the conditions prescribed in 2.3.4.2.2 (a) to (e), inclusive, at a speed equal to $1.4V_{s_1}$, any uncorrectable asymmetrical fuel consumption being provided for.

2.4.2.3 *Any two engines inoperative.* (Aeroplanes with four or more engines).

Longitudinal, lateral and directional trim, in the conditions prescribed in 2.3.4.3 (c), (d) and (e), and with the aeroplane weight such that the two engine inoperative rate of climb at 1,500 meters (5,000 feet) is not less than an approved minimum.

RECOMMENDATION: The approved minimum should be:

$0.196 \left(\frac{V_{s_0}}{100}\right)^2$ meters per second ($0.01V_{s_0}^2$ feet per minute), V_{s_0} being expressed in kilometers (miles) per hour.

2.4.3 *Stability.* The aeroplane shall have such stability in relation to its other flight characteristics, performance, structural strength, equipment, operating limitations, and most probable operating conditions, as to ensure that demands made on the pilot's powers of concentration are not excessive, when the stage of the flight at which these demands occur, and their duration, are taken into account. The stability of the aeroplane shall not, however, be such that excessive demands are made on the pilot's strength, or that the safety of the aeroplane is prejudiced by lack of maneuverability in emergency conditions.

The standards of 2.4.3.1 to 2.4.3.5, inclusive, prescribe certain flying qualities, compliance with which represents the minimum acceptable level of safety for a conventional aeroplane intended for normal conditions of operation except

that different stability characteristics during periods in which the aeroplane is under the control of a suitable automatic pilot are acceptable.

2.4.3.1 *Static longitudinal stability.* In the configurations prescribed in 2.4.3.1.1, and with the aeroplane trimmed accordingly, the characteristics of the elevator control forces and elevator control system friction shall be such that:

(a) A pull shall be required to obtain and maintain speeds below the specified trim speed, and a push shall be required to obtain and maintain speeds above the specified trim speed; this shall be so at any speed between the minimum speed in steady unstalled flight and the appropriate maximum permissible speed which can be obtained without excessive control forces;

(b) The airspeed shall return to within 10% of the original trim speed when the control force is slowly released from any speed within the limits defined in (a).

2.4.3.1.1 *Specific conditions.* In the conditions of (a) to (e) inclusive, within the speeds prescribed, the slope of the stick force against speed curve shall be stable, and shall be such that any substantial change in speed is clearly perceptible to the pilot through a resulting change in stick force.

(a) *Landing.* At all speeds between $1.1V_{s_1}$ and $1.6V_{s_1}$, with:

(i) Throttles set for not more than zero thrust at the trimmed speed;

(ii) Landing gear extended;

(iii) Wing flaps in the maximum landing position;

(iv) Aeroplane weight equal to the maximum sea level landing weight;

(v) Aeroplane trimmed for a speed equal to $1.4V_{s_1}$.

Under these conditions, the stick force shall not exceed 36 kilograms (80 pounds).

(b) *Approach.* At all speeds between $1.1V_{s_1}$ and $1.8V_{s_1}$ with:

(i) Engine power necessary to maintain level flight at a speed equal to $1.4V_{s_1}$;

(ii) Landing gear retracted;

(iii) Wing flaps in the maximum approach position;

(iv) Aeroplane weight equal to the maximum sea level landing weight;

(v) Aeroplane trimmed for a speed equal to $1.4V_{s_1}$.

(c) *Climb.* At all speeds between 85% and 115% of the speed for which the aeroplane is trimmed, with:

(i) Engines operating at 75% of maximum continuous power;

(ii) Landing gear retracted;

(iii) Wing flaps retracted;

(iv) Aeroplane weight equal to the maximum sea level take-off weight;

(v) Aeroplane trimmed for the best rate of climb speed except that the trimmed speed need not be less than $1.4V_{s_1}$.

(d) *Cruising, landing gear retracted.* At all speeds obtainable with a stick force not in excess of 22.5 kilograms (50 pounds), between $1.3V_{s_1}$ and V_{NE}, with:

(i) Engines operating at 75% of maximum continuous power;

(ii) Landing gear retracted;

(iii) Wing flaps retracted;

(iv) Aeroplane weight equal to the maximum sea level take-off weight;

(v) Aeroplane trimmed for level flight with 75% of the maximum continuous power.

(e) *Cruising, landing gear extended.* At all speeds obtainable with a stick force not in excess of 22.5 kilograms (50 pounds), between $1.3V_{s_1}$ and the speed in level flight corresponding with the following prescribed conditions with:

(i) Engines operating at 75% of maximum continuous power;

(ii) Landing gear extended;

(iii) Wing flaps retracted;

(iv) Aeroplane weight equal to the maximum sea level take-off weight;

(v) Aeroplane trimmed for level flight at 75% of the maximum continuous power.

2.4.3.2 *Dynamic longitudinal stability.* The dynamic longitudinal stability shall be such that any short period oscillation of the control surfaces, of the control system, or of the aeroplane as a whole occurring between the stalling speed and the maximum permissible speed appropriate to the configuration of the aeroplane shall be heavily damped with the elevator control both free and fixed.

NOTE: This does not refer either to the phugoid motion, or to any short period oscillation associated with pre-stall buffeting.

2.4.3.3 *Static directional stability.* The static directional stability, as shown by the tendency to recover from a skid with rudder free, shall be positive at all landing gear and wing flap positions and symmetrical power conditions, and at all speeds from $1.2V_{s_1}$ up to the appropriate maximum permissible speed.

2.4.3.4 *Static lateral stability.* The static lateral stability, as shown by the tendency to raise the low wing in a sideslip, shall be positive within the limits and conditions prescribed in 2.4.3.3.

In straight steady sideslips (unaccelerated forward slips), with the aeroplane trimmed for straight flight without sideslip, the aileron control and rudder control movements and forces shall increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased. The rate of increase shall lie between satisfactory limits up to the maximum sideslip angles considered appropriate to the operation of the aeroplane. At greater angles, up to that at which the full rudder control is employed or a rudder pedal force of 81.5 kilograms (180 pounds) is obtained, the rudder pedal forces shall not reverse, and increased rudder deflection shall not produce decreased angles of sideslip.

Sufficient bank shall accompany sideslipping to indicate adequately any departure from steady unyawed flight, unless a satisfactory yaw indicator, reliable under the most adverse operating conditions for which certification is sought, is provided.

2.4.3.5 *Dynamic lateral and directional stability.* The dynamic lateral and directional stability shall be such that any short period oscilation occurring between stalling speed and the maximum permissible speed appropriate to the configuration of the aeroplane shall be heavily damped with the primary controls both free and fixed.

2.4.4. *Stalling, symmetrical power.*

2.4.4.1 *General.* Stalls shall be demonstrated:

(i) With engine power off, and

(ii) With that power necessary to maintain level flight at a speed equal to $1.6V_{s_1}$, when the landing gear is retracted, the wing flaps are in the approach position, and the aeroplane weight is equal to the maximum sea level landing weight.

In each case, it shall be possible to correct roll and yaw, if they occur in the test maneuver described in 2.4.4.6, by unreversed use of the aileron and rudder controls, up to the moment at which the aeroplane pitches, with:

(a) Wing flaps and landing gear in any combination of positions likely to be sustained in flight;

(b) Center of gravity in the plane of symmetry of the aeroplane in the most adverse position for recovery;

(c) All appropriate aeroplane weights;

(d) Aeroplane in straight flight and in turns with bank up to 30 degrees.

2.4.4.2 *Stall warning.* Clear and distinctive stall warning shall be apparent to the pilot at a speed at least 5% above the stalling speed, with wing flaps and landing gear in any combination of positions likely to be sustained in flight, both in straight and in turning flight.

NOTE: The warning may be furnished by the inherent aerodynamic qualities of the aeroplane, by a suitable instrument, or by any equivalent means which will give clearly distinguishable indications under all normal conditions of operation.

2.4.4.3 *Straight flight stalls.* In straight flight stalls, the roll occurring between the initiation of the pitching movement and the completion of the recovery shall not exceed a safe limit, assumed to be approximately 20 degrees for the average of a number of tests.

2.4.4.4 *Turning flight stalls.* The roll following the stall during turning flight shall not be so violent or so extreme that it is difficult with normal piloting skill to make a prompt recovery and regain control of the aeroplane without exceeding the maximum permissible airspeed or the allowable limit load factors.

2.4.4.5 *Operating information.* The effect of varying the settings of such items as cowl flaps or radiator shutters shall be investigated, and marked variations in the stalling characteristics resulting therefrom shall be entered in the Aeroplane Flight Manual.

The approximate loss of altitude between the initial stall and the recovery to level flight, together with the conditions under which it is determined, shall be entered in the Aeroplane Flight Manual. In determining this loss of altitude, engine power shall not be applied until a speed equal to $1.2V_{s_1}$ is reached.

2.4.4.6 *Test maneuver.* The aeroplane shall be trimmed for a speed of approximately $1.4V_{s_1}$. From a value sufficiently above the stalling speed to ensure that a steady rate of decrease is obtainable, the speed shall be reduced at a rate not exceeding 1.5 kilometers (1 mile) per hour per second, until the aeroplane commences a large amplitude pitching or rolling motion, or until the elevator control reaches its stops. In

the case where the aeroplane commences a large amplitude pitching or rolling motion, normal use of the elevator control for recovery shall not be made until after the uncontrollable downward pitching motion is unmistakably developed.

2.4.5 *Stalling, asymmetrical power.* The aeroplane shall not display any undue spinning tendency, and it shall be possible to effect a safe recovery without applying power to the inoperative engine, when the aeroplane is stalled in straight flight, with:

(a) Critical engine inoperative;

(b) Remaining engines operating at 75% of maximum continuous power, except that the power need not be greater than that at which:

(i) The limit of a primary flight control travel is reached;

(ii) A control force is encountered which is sufficiently greater than those normally encountered in cruising flight, with the critical engine inoperative, to ensure that the aeroplane could not be stalled inadvertently in this condition; if the rudder control force is the limiting factor, the minimum acceptable value shall be 8.15 kilograms (180 pounds);

(c) Landing gear retracted;

(d) Wing flaps retracted;

(e) Center of gravity in the plane of symmetry of the aeroplane in the most adverse position for recovery.

2.5 *Flutter and vibration.* All parts of the aeroplane shall be demonstrated to be free from flutter and excessive vibration under all aeroplane configurations and speed and power conditions appropriate to operation within the operating limitations (see 9.2.2); in addition, compliance with this standard shall be demonstrated with the wing flaps and landing gear retracted up to the demonstrated flight diving speed V_{DF}, which, when converted to EAS, shall be not less than $V_{D_{min}}$.

In any normal flight condition, there shall be no buffeting severe enough to interfere with the satisfactory control of the aeroplane, or to cause structural damage to the aeroplane or excessive fatigue to the crew.

NOTE: Buffeting as a stall warning is considered desirable, and discouragement of this type of buffeting is not intended.

2.6 *Ground handling characteristics.*

2.6.1 *Longitudinal stability and control.* There shall be no uncontrollable tendency for landplanes to nose over in any normal condition of operation, or when rebound occurs during landing or take-off. Wheel brakes shall operate smoothly and shall exhibit no undue tendency to induce nosing over.

2.6.2 *Directional stability and control.* (a) There shall be no uncontrollable ground-looping tendency in 90 degree crosswinds of velocity up to $0.2V_{s_0}$, at any necessary speed upon the ground.

(b) It shall be demonstrated that no exceptional skill or alertness, on the part of the pilot, is required for satisfactory control of landplanes during landings at normal landing speed, with power off at contact. Brakes or engine power shall not be used to maintain a straight path, until the speed has fallen to approximately half the landing speed.

(c) Means shall be provided for adequate directional control during taxying.

2.6.3 *Crosswind.* There shall be established a lateral component of wind velocity at and below which it is safe to take-off or land.

2.7 *Water handling characteristics.*

2.7.1 *Control and stability on the water.* In taking-off, taxying, and alighting, the seaplane shall not exhibit:

(a) Any dangerous uncontrollable porpoising, bouncing, or swinging tendency;

(b) Any submerging of auxiliary floats or sponsons, any immersion of wing tips, propeller blades, or other parts of the seaplane which are not designed to withstand the water loads;

(c) Any spray forming which would dangerously obscure the pilot's view, cause damage to the seaplane, or result in ingress of an undue quantity of water.

2.7.1.1 *Tests.* Compliance with 2.7.1 shall be shown:

(a) In wind and water conditions in which the seaplane is likely to be operated on the water;

(b) At all speeds at which the seaplane is likely to be operated on the water;

(c) With sudden failure of the critical engine, occurring at any moment;

(d) At all seaplane weights and centre of gravity positions within the range of loading conditions, for which certification is sought, relevant to each condition of operation.

The conditions under which the tests have been carried out shall be entered in the Aeroplane Flight Manual.

2.7.2 *Drift.* In all normal conditions of wind and water, the seaplane shall be able to drift safely for 5 minutes with engines inoperative, aided if necessary by a sea anchor (drogue).

2.7.3 *Mirage landing.* It shall be demonstrated in smooth water conditions that the seaplane can perform a safe landing at maximum sea level landing weight, when maintained in steady flight from the initiation of the approach up to the moment of contact with the water. The approach conditions shall be entered in the Aeroplane Flight Manual.

CHAPTER 3—STRUCTURES

3.1 *General.* The standards of chapter 3 apply to the aeroplane structure consisting of all portions of the aeroplane, the failure of which would seriously endanger the aeroplane.

3.1.1 *Weight and weight distribution.* Unless otherwise stated, all structural standards shall be complied with:

(a) At all weights from the design minimum weight to the design maximum weight; the design maximum weight shall be not less than the design take-off weight;

(b) When the center of gravity of the aeroplane is in the most adverse positions compatible with the weight assumed, within the range for which certification is sought;

(c) When the weight is distributed in the most adverse manner, within the operating limitations on the basis of which certification is sought.

3.1.1.1 *Design unit weights.* The following weights shall be used to show compliance with the structural standards:

Gasoline (petrol): 0.72 kilogram per liter, (6 pounds per U. S. gallon and 7.2 pounds per Imp. gallon);

Lubricating: 0.9 kilogram per liter, (7.5 pounds per U. S. gallon and 9 pounds per Imp. gallon);

Crew and passengers: 77 kilograms per person (170 pounds per person).

NOTE: True weights may be used when establishing the current operating weight of the aeroplane.

3.1.2 *Strength.*

NOTE: Strength standards prescribed design loading conditions which are, so far as possible, specified in terms of flight and ground maneuvers, and of atmospheric gusts.

The external loads arising in the prescribed loading conditions shall be placed in equilibrium with appropriate inertia loads.

3.1.2.1 *Limit and ultimate loads.* Except as otherwise qualified, the loads obtained from the prescribed loading conditions shall be considered as limit loads (see Part I, par. 4).

The ultimate loads shall be obtained by multiplying the limit loads by the prescribed factor of safety.

NOTE: The factor of safety applies to the external and inertia loads and not to the internal stresses arising from these.

3.1.2.2 *Factor of safety.* The factor of safety shall be at least 1.5 unless otherwise prescribed. Where there is uncertainty about the strength of parts of the structure (e. g., fittings, castings, etc.) or where inspection in service is difficult, such parts shall be designed with factors of safety which can be expected reasonably to make them as reliable as the rest of the structure.

NOTE: Main causes of uncertainty may be the absence of tests, likely variability, and possible deterioration in service.

3.1.2.3 *Strength and deformation.* For all critical loading conditions:

(a) At all loads up to the limit load, no part of the aeroplane structure shall sustain detrimental deformations, and the functioning of moving parts shall be satisfactory if essential for safety in the operating conditions corresponding with the loads;

(b) After removal of the limit load, no permanent detrimental deformation shall be present in any part of the aeroplane structure;

NOTE: Permanent overall deformation of the order of 5% of the deformation occurring at the limit load will usually be considered not detrimental.

(c) The aeroplane structure as a whole shall be capable of supporting the ultimate load;

(d) Parts of the aeroplane structure in which the internal loads increase less rapidly than the external loads (e. g., parts with high initial stresses or beams under combined tension and bending loads) shall be investigated for loads below the limit load to ensure that the permanent deformation of such parts does not occur much before the permanent deformation of the remainder of the structure;

(e) If deflection or deformation under load would significantly change the dis-

tribution and magnitude of external or internal loads, such redistribution shall be taken into account;

(f) Where the structural flexibility is such that the maximum rate of application of loads that is likely to occur in the operating conditions corresponding with a specified load, may produce transient stresses appreciably higher than the stresses corresponding with the static load, the effects of such rate of application shall be taken into account.

3.1.3 *Calculations and test procedures.* Compliance with 3.1.2.3 shall be established by tests and calculations, but calculations shall only be used where the structure is of a type for which experience has shown that calculations can be relied on to provide substantiating evidence.

Where supporting data justify the use of simplified design criteria, such criteria may be used provided that they will ensure a level of safety not less than that obtainable by a rational investigation of the prescribed conditions.

In making tests to establish that the structure has the strength prescribed for limit load conditions, the limit load shall be supported for at least one minute. The load shall be applied with sufficient rapidity to constitute a substantiating test.

NOTE: It is not intended that the loading should be so rapid that the effects usually associated with dynamic or shock loading are reproduced.

In making tests to establish that the structure has the strength prescribed for ultimate load conditions, the ultimate load shall be applied for a period sufficient to demonstrate that the structure is capable of supporting the ultimate load. This period shall not be less than three seconds.

3.1.3.1 *Properties of materials.* The mechanical properties and the dimensions of structural elements, which are assumed in design calculations, shall be chosen so that the probability of any structure having a strength less than the design value, due to variations of mechanical properties and dimensions in materials, is extremely remote. All assumed values of strength and elastic properties shall be suitably related to the values quoted in the specification with which the material complies.

3.1.3.2 *Correction of test results.* The results obtained from strength tests shall be corrected for deviations from the mechanical properties and dimensions assumed in the design calculations so as to establish that the probability of any structure having a strength less than the design value, due to variations of mechanical properties and dimensions, is extremely remote.

3.2 *Design airspeeds.* Except as limited by compressibility hazards, the design airspeeds of 3.2 apply to all altitudes from sea level to 6,100 meters (20,000 feet).

NOTE: Above 6,100 meters (20,000 feet) altitude, the design airspeeds may be modified in a manner which will not lower the implied level of safety.

Design airspeeds shall be equivalent airspeeds (EAS). The design airspeeds V_F, V_B, V_C, and V_D, shall be selected by the applicant, but shall be not less than the minimum values prescribed below, and denoted by the suffix "min". The design values of the stalling speeds V_{s_0} and V_{s_1} for structural design purposes shall be selected so as to approximate actual values closely or to represent them conservatively.

NOTE: The manner in which the design airspeeds are used in determining the airspeed operating limitations is prescribed in 9.2.2.

3.2.1 V_F. The design flap speed, power off. $V_{F_{min}}$ shall be equal to $1.4V_{s_1}$ or $1.6V_{s_0}$, whichever is the greater, where V_{s_1} is the stalling speed, with wing flaps retracted, at design landing weight; modification of $V_{F_{min}}$ is acceptable where devices are provided which limit automatically the load on wing flaps (see 3.3.2.1 and 4.2.4).

3.2.2 V_A. The design maneuvering speed. V_A shall be equal to $V_{s_1}(n_1)^{1/2}$, where V_{s_1} is the stalling speed with wing flaps retracted, at design maximum weight, and n_1 is the design value of the maneuvering load factor selected as prescribed in 3.3.1.2.

3.2.3 V_B. The design speed for maximum gust intensity. $V_{B_{min}}$ shall be sufficiently greater than V_{s_1} to provide adequate protection against loss of control in turbulent air, where V_{s_1} is the stalling speed with wing flaps and landing gear retracted, at design maximum weight.

Except where data substantiate the use of another value $V_{B_{min}}$ shall be either the speed determined by the intersection of the line representing the maximum static lift coefficient and the line representing the maximum prescribed gust velocity on the gust V–n diagram (see fig. 3–2) or $1.6V_{s_1}$, whichever is the lesser.

3.2.4 V_C. The design cruising speed. $V_{C_{min}}$ shall be sufficiently greater than V_B to provide for inadvertent speed increases likely to occur as a result of severe atmospheric turbulence.

Except where data substantiate the use of another value $V_{C_{min}}$ shall be V_B+80 kilometers (50 miles) per hour, but need not exceed 0.9 times the speed which the aeroplane is capable of attaining at maximum continuous power in level flight at the corresponding altitude.

3.2.5 V_D. The design diving speed. $V_{D_{min}}$ shall be sufficiently greater than V_C to provide for safe recovery from inadvertent upsets occurring at V_C, and shall be sufficiently greater than V_A to provide for the execution of all maneuvers permitted by the operating limitations, without requiring exceptional skill on the part of the pilot.

Except where data substantiate the use of another value $V_{D_{min}}$ shall be V_C+113 kilometers (70 miles) per hour, but need not exceed the terminal velocity in a dive at 30 degrees to the horizontal.

NOTE: The standards prescribe flight tests involving dives at speeds up to $V_{D_{min}}$. The applicant may therefore consider it desirable to provide structural strength for a greater speed, so as to safeguard the aeroplane during flight tests.

3.3 *Flight loads.* The air and inertia loads resulting from the specified maneuvers and gusts shall be distributed so as to approximate actual conditions closely or to represent them conservatively.

3.3.1 *Symmetrical loading conditions with wing flaps retracted.* The aeroplane structure shall have sufficient strength to withstand the loads corresponding with all combinations of airspeed and load factor on and within the boundaries of the V–n diagrams shown in figures 3–1 and 3–2.

NOTE: The standards which follow prescribe the conditions for constructing maneuvering and gust V–n diagrams similar to the examples shown in figures 3–1 and 3–2.

A sufficient number of points on and within the maneuvering and gust V–n diagrams shall be investigated to ensure that the critical loads for each part of the aeroplane structure have been obtained.

NOTE: A conservative combined envelope may be used for this purpose, if desired.

The forces acting on the aeroplane shall be placed in equilibrium in a rational or conservative manner.

NOTE: In establishing such equilibrium it may be assumed that:

(a) The loads on the wing and horizontal tail surfaces are balanced by inertia forces;

(b) The pitching moments produced by the aerodynamic loads on the aeroplane are balanced by moments due to inertia forces.

3.3.1.1 *Maneuvering V–n diagram.* The aeroplane shall be assumed to be subjected to symmetrical maneuvers resulting in all possible combinations of airspeed and load factor represented by the maneuvering V–n diagram shown in figure 3—1. Zero pitching acceleration shall be assumed, except under the conditions prescribed in 3.3.1.3.

3.3.1.2 *Maneuvering load factors.* The values of n_1, n_2, n_3, n_4, on the maneuvering V–n diagram (see fig. 3—1), shall be selected by the applicant as follows:

$$n_1>2.5$$
$$n_2<0$$
$$n_3<-1$$
$$n_4>2.0$$

RECOMMENDATION: As the minimum value of 2.0 prescribed for n_4 is regarded as an absolute minimum, consideration should be given to the possibility of a need to use values of n_4 up to 2.5 or $0.75n_1$, whichever is the greater, to maintain the desired level of safety.

NOTE: The minimum values for the maneuvering load factors prescribed in 3.3.1.2 have been fixed as those compatible with safety under closely controlled operating conditions. It may be desirable to provide for other operating conditions such as the following:

(a) Operations in which pilot technique in respect of maneuvering loads imposed, is likely to vary with the size or maneuverability of the aeroplane; for such operations, values for the maneuvering load factors may be taken as:

$$n_1=2.1+\frac{10,890}{W(\text{kg.})+4,540}$$

$$\left(n_1=2.1+\frac{24,000}{W(\text{lbs.})+10,000}\right.$$

but n_1 need not be greater than 3.5; and $n_4=0.75\,n_1$.

(b) Unusual operating conditions (e. g., flights through valleys in mountainous terrain), which necessitate exceptionally maneuverable aeroplanes; higher positive load factors may be required, depending upon the other aeroplane characteristics which affect maneuverability.

3.3.1.3 *Checked pitching maneuvers.* The aeroplane shall be assumed to reach, but not to exceed, the maximum positive maneuvering load factor appropriate to the speed, by a checked maneuver from initial conditions of steady level flight at all speeds between V_A and V_D.

3.3.1.3.1 *Definition of checked maneuver.* A checked maneuver is a maneuver from prescribed initial conditions of flight, in which a control is suddenly displaced in one direction and later is displaced in the opposite direction, the second displacement possibly being less rapid than the first. The initial flight conditions and the displacements and timing shall be such as to produce the most severe loading conditions which are likely to occur in operation, with due regard to the likely maximum pilot maneuvering effort. When any part of the maneuver is assumed limited by pilot effort, accurate or conservative hinge moment data shall be used. Account shall be taken of the assistance given to the pilot by servo mechanisms and automatic devices, by the manipulation of trimming devices, and by trimming devices set in a reasonable position out of trim.

NOTE: In the absence of more accurate information of the maximum pilot maneuvering efforts, likely in a particular aeroplane type, the following values may be assumed:

TABLE 3-I—PILOT MANEUVERING EFFORTS

Control	Effort
Aileron:	
Stick lateral	22.5 kilograms (50 pounds).
Wheel	22.5*D* kilogrammeters [1] (50*D* inch pounds).
Elevator:	
Stick	67.5 kilograms (150 pounds).
Wheel	90 kilograms (200 pounds).
Rudder bar or pedals	135 kilograms (300 pounds).

[1] *D* equals the diameter of the control wheel in meters (inches).

3.3.1.4 *Gust V–n diagram.* The aeroplane shall be assumed to be subjected to symmetrical loads resulting from encountering in straight level flight the up and down gusts prescribed in 3.3.1.4.1; for the purpose of determining design loads equivalent sharp-edged gusts may be used in accordance with 3.3.1.4.4.

3.3.1.4.1 *Gust velocities.* At all altitudes up to 7,600 meters (25,000 feet), the design maximum velocities of the gust shall be not less than:

(a) At speed V_B, 20.10 meters (66 feet) per second;

(b) At speed V_C, 15.25 meters (50 feet) per second;

(c) At speed V_D, 7.60 meters (25 feet) per second.

NOTE: The gust *V–n* diagram shown in figure 3–2 represents the loading conditions expressed in terms of aeroplane load factor and speed as defined by these gust velocities. In figure 3–2 the lines representing the prescribed gust velocities are shown as straight lines on the assumption of equivalent sharp-edged gusts and the use of appropriate alleviating factors; V_B is assumed to be $V_{B_{min}}$, i. e., it is shown by the intersection of the line representing the load factors at the maximum static lift coefficient and the line representing the load factors at the maximum prescribed gust velocity.

For altitudes above 7,600 meters (25,000 feet) assumptions of the gust velocities shall be made such as will maintain the same implied level of safety.

NOTE: Little is known about gust velocities or their frequency of occurrence above 7,600 meters (25,000 feet). It is known that gust velocities (EAS) may remain approximately constant to some higher altitudes, whereas the frequency of occurrence decreases as altitude increases. On a probability basis, it is believed that the present meager information indicates that constant level of safety may be maintained by assuming that the design gust velocities (EAS) drop linearly with altitude from the values prescribed for 7,600 meters (25,000 feet) to 60% of these values at 15,200 meters (50,000 feet).

3.3.1.4.2 *Gust gradient distance.*

RECOMMENDATION: In the absence of better information, it should be assumed that the vertical gust velocity increases steadily from zero to its maximum value while the aeroplane travels a distance of 30 meters (100 feet).

NOTE: Little is known about the true relationship of gust velocities and gradient distances. If reliable information is available regarding this relationship in the atmosphere, appropriate combinations of gust velocity and gradient distance giving the most severe loads may be assumed.

3.3.1.4.3 *Transient stresses.* Where an investigation of transient stresses is required in accordance with 3.1.2.3 (f), a range of gust gradient distances shall be considered.

NOTE: Investigation of transient stresses may be unnecessary if:

$\frac{V}{f}$ < the assumed gradient distance in meters (feet);

where:

V = flight speed (TAS) in meters (feet) per second;

f = fundamental frequency of symmetrical wing bending in cycles per second.

3.3.1.4.4 *Equivalent sharp-edged gusts.* For design purposes, the prescribed gust conditions may be converted into equivalent sharp-edged gust conditions, provided that the flight stability is not abnormal and the natural frequencies of the aeroplane do not lead to transient overstresses.

NOTE: When determining equivalent sharp-edged gust conditions, a suitable approximation is to assume that the effect of a gust of maximum velocity U is a change in the angle of attack of the wing by an amount equal to:

$$\text{arc tan } \frac{FU}{V}$$

where:

F is alleviating factor computed by the following formulae (see also fig. 3–3):

$F = 0.2\left(\frac{W}{S}\right)^{\frac{1}{2}}$, for $\frac{W}{S}$ less than 78 kilograms per square meter

($F = 0.3\left(\frac{W}{S}\right)^{\frac{1}{2}}$, for $\frac{W}{S}$ less than 16 pounds per square foot);

$F = 0.8 - \frac{5.25}{\left(\frac{W}{S}\right)^{\frac{1}{2}}}$, for $\frac{W}{S}$ greater than 78 kilograms per square meter

($F = 0.8 - \frac{1.6}{\left(\frac{W}{S}\right)^{\frac{1}{2}}}$, for $\frac{W}{S}$ greater than 16 pounds per square foot);

and,

V is the flight speed (EAS);

W is the appropriate aeroplane design weight;

S is the design wing area.

The attitude and speed of the aeroplane are assumed to remain constant.

The above alleviating factor is suitable only when used with aerodynamic data based on steady flow conditions.

3.3.1.4.5 *Horizontal tail surface gust loads.*

RECOMMENDATION: In the absence of a rational analysis and when equivalent sharp-edged gusts are used, the horizontal tail surface loads should be calculated by adding to the initial tail load in steady level flight the airload increment due to the angle of attack increment as calculated by the method used for the wing but taking due account of wing downwash. Equilibrium of pitching moments may be achieved by assuming appropriate pitching inertia forces.

NOTE: The tail loads due to gust, calculated in accordance with this recommendation, though generally conservative for the tail surfaces, may represent conditions which are not the most severe for the fuselage. If gust conditions appear to be critical for the fuselage, a second design case neglecting tail load increments due to gust may be necessary.

3.3.2 *Loading conditions with wing flaps extended.* The standards of 3.3.2 shall apply where wing flaps, or other auxiliary high lift devices intended for use at relatively low airspeeds, are installed.

3.3.2.1 *Symmetrical maneuvering and gust conditions.* The aeroplane structure shall have sufficient strength to withstand the following symmetrical loads, at the design flap speed V_F chosen in accordance with 3.2, with wing flaps in the landing position and also with wing flaps in any intermediate position which will produce critical loads in any part of the aeroplane:

(a) Loads corresponding with a positive maneuvering load factor n_s equal to 2.0, as represented by point *I*, on figure 3–1; zero pitching acceleration may be assumed;

(b) Loads resulting from encountering up and down gusts of 7.60 meters (25 feet) per second (EAS) velocity when the aeroplane is in straight level flight; for the purpose of determining design loads, equivalent sharp-edged gusts may be used in accordance with 3.3.1.4.4;

RECOMMENDATION: Gust gradients should be considered in accordance with 3.3.1.4.2 and horizontal tail surface loads in accordance with 3.3.1.4.5.

NOTE: If equivalent sharp-edged gusts are used, the loads will be represented by point *I'* and *J'* on figure 3–2.

(c) Loads resulting from encountering a rearward gust of 7.60 meters (25 feet) per second velocity along the flight

path when the aeroplane is in straight level flight; no alleviation shall be assumed.

Where automatic flap load limiting devices are fitted, the aeroplane structure may be designed for the critical combinations of airspeed and wing flap position permitted by the device (see 4.2.4).

For the take-off wing flap position, consideration shall also be given to the possibility that speeds higher than V_F may be required by the performance characteristics of the aeroplane.

3.3.2.2 *Slipstream effects.* The wing flaps, their supporting structure and operating mechanism, shall have sufficient strength to withstand the loads resulting from the effects of slipstream, for all symmetrical power conditions from that corresponding to zero thrust to the maximum take-off power, under the following conditions:

(a) Design landing weight, wing flaps in both the approach and landing positions, and airspeed equal to V_F;

(b) Design take-off weight, wing flaps in the take-off position, and airspeed equal to V_F, except that if the applicant has declared a higher speed for use with wing flaps in the take-off position (see 3.3.2.1), this higher speed shall apply.

3.3.2.3 *Asymmetrical loading conditions.* The aeroplane structure shall have sufficient strength to withstand the loads imposed when the wing flaps on one side are carrying the most severe loads occurring in the prescribed symmetrical conditions and those on the other side are carrying not more than 80% of that load.

NOTE: See 4.2.4.1 for wing flap interconnection.

Strength shall be provided for an asymmetrical loading which occurs when the engines on one side of the plane of symmetry are inoperative, and the remaining engines are operating at maximum take-off power.

3.3.3 *Asymmetrical loading conditions with wing flaps retracted.* The aeroplane structure shall have sufficient strength to withstand the loads resulting from the following rolling and yawing conditions.

3.3.3.1 *Rolling conditions.*

3.3.3.1.1 *Maneuvers.* From all initial conditions of symmetrical flight within the positive portion of the maneuvering V–n diagram (fig. 3–1) up to load factors of not lower than 2.0, or 0.67 of the maximum load factor appropriate to the speed, whichever is the lesser, the aeroplane shall be assumed to be subjected to a checked aileron maneuver in accordance with the general definition of checked maneuver in 3.3.1.3.1.

RECOMMENDATION: In the absence of information substantiating more accurate assumptions, the aeroplane, at the speeds V_A, V_C, and V_D, should be assumed to be subjected to the symmetrical flight conditions of figure 3–1 both with a load factor equal to zero and with one not lower than 2.0, or 0.67 times the appropriate maximum positive load factor, whichever is the lesser.

From each of these symmetrical conditions it should be assumed that both an accelerated roll with the rate of roll equal to zero (neglecting aerodynamic lag) and a steady roll, are produced. For each of these four cases, except as limited by the pilot maneuvering effort, the following aileron deflections should be considered:

(a) At speed V_A, the aileron deflection obtained when the aileron control is displaced to the stop;

(b) At speed V_C, when V_C is greater than V_A, the aileron deflection necessary to produce a steady rate of roll not less than that obtained in (a) except that the rate of roll need not exceed $\frac{10.65}{b}$ radians per second, where b is the span in meters ($\frac{35}{b}$ radians per second, where b is the span in feet);

(c) At speed V_D, the aileron deflection necessary to produce a steady rate of roll not less than ⅓ of that of (b).

This recommendation is subject to the exception that where information regarding the damping moment of the aeroplane is limited, and where the torsional rigidity of the wing is sufficient to warrant ignoring torsional deformation, the aileron deflection for (b) may be taken as that necessary to give equal rolling moment to that of (a), and for (c) may be taken as that necessary to give ½ of the rolling moment of (a).

3.3.3.1.2 *Vertical gusts.* The aeroplane shall be assumed to be subjected to the loads resulting from an asymmetrical distribution of vertical gust velocities.

NOTE: In the absence of more accurate substantiating information the following may be assumed:

The air load acting on the wing on one side of the plane of symmetry is the greater of the loads resulting from the symmetrical flight condition at point B' and at point C' on Figure 3–2. The air load acting on the wing on the other side of the plane of symmetry is that resulting from similar symmetrical flight conditions but is 20% less. The difference is assumed to be caused by an appropriate reduction in the magnitude of the gust velocity.

3.3.3.2 *Yawing conditions.*

3.3.3.2.1 *Maneuvers.* From initial conditions of steady straight level flight at all speeds up to V_D the aeroplane shall be assumed to be subjected to a checked yawing maneuver in accordance with the general definition of checked maneuver given in 3.3.1.3.1.

RECOMMENDATION: In the absence of information substantiating more accurate assumptions, the aeroplane when at a steady speed V_A with the rate of yaw and the angle of bank equal to zero, should be assumed to be subjected to the following rudder control displacements and yawing angles, except as limited by pilot maneuvering effort:

(a) Rudder control displaced to the stop, aeroplane at zero yaw;

(b) Rudder control displaced to the stop, aeroplane yawed to an angle which should be at least 1.2 times the angle of equilibrium in yaw, except that it need not exceed 30°;

(c) Rudder control in neutral position, aeroplane yawed to 0.8 times the angle of equilibrium in yaw which would be obtained if the aeroplane were in steady flight at speed V_A, with the rudder control displaced to the stop.

No account should be taken of aerodynamic lag.

3.3.3.2.2 *Lateral gusts.* At all altitudes from sea level up to 7,600 meters (25,000 feet), the aeroplane shall be assumed to encounter a 15.25 meter (50 foot) per second gust perpendicular to the plane of symmerty while in steady flight at speed V_C.

NOTE: The reduction in gust velocity at high altitudes indicated under 3.3.1.4.1 applies also to lateral gusts.

In the absence of better information the specified gust conditions may, for design purposes, be converted into equivalent sharp-edged gust conditions. A suitable approximation is to assume that the effect of a lateral gust of maximum velocity U is a change in the angle of attack of the vertical tail surfaces by an amount equal to

$$\arctan \frac{F_1 U}{V_C}$$

where F_1 is an alleviating factor shown in figure 3—4. The attitude and speed of the aeroplane are assumed to remain constant.

The above alleviating factors are suitable only when used with aerodynamic data based on steady flow conditions.

3.3.4 *Supplementary loading conditions.*

3.3.4.1 *Effects of engine operation.* The engine mounting, and the structure in the vicinity of the engine, shall have sufficient strength to withstand the loads corresponding with the specified flight and ground load conditions, in combination with appropriate engine torque, thrust, and gyroscopic moments. Fluctuation of torque, particularly in the case of engines with a small number of cylinders, shall be considered.

3.3.4.2 *Pressure cabin loads* (see also 4.9). The aeroplane structure shall have sufficient strength to withstand the flight loads combined with pressure differential loads from zero up to the maximum settings of the relief valves. Account shall be taken of the external pressure distribution in flight.

If landings are to be permitted with the cabin pressurized, landing loads shall be combined with pressure differential loads from zero up to the maximum to be permitted during landing.

The aeroplane structure shall also have sufficient strength to withstand the pressure differential loads corresponding with the maximum settings of the relief valves, with a suitable margin to provide for such effects as fatigue and stress concentration.

NOTE: A pressure load corresponding to 1.33 times the maximum relief valve setting is considered to provide a satisfactory margin. All other loads may be omitted in this case.

Where a pressurized cabin is separated into two or more compartments by bulkheads or floor, the primary structure shall be designed for the effects of sudden release of pressure in any compartment having external doors or windows. This condition shall be investigated for the effects resulting from the failure of the largest opening in a compartment. Where inter-compartment venting is provided, the effects of such venting may be taken into account.

3.3.5 *Control surface loads.* The control surfaces shall have sufficient strength to withstand the loads resulting from the symmetrical and asymmetrical flight conditions prescribed in 3.3 and shall comply with the standards of 3.3.5.

3.3.5.1 *Horizontal tail surfaces.* Horizontal tail surfaces shall be designed for asymmetrical loads arising from yawing and slipstream effects in combination with the symmetrical flight conditions.

NOTE: The magnitude of the asymmetrical loads on the horizontal tail depends upon the yaw angles attained in combination with symmetrical loading conditions represented

by the maneuvering *V–n* diagram (fig. 3–1) and upon the general arrangement of the fuselage, wing, and horizontal and vertical tail surfaces. The yaw angles in these combined conditions may be the result of various causes (e. g., by rolling the aeroplane without proper use of the rudder, in which case the yaw angle depends upon the directional stability and yaw due to ailerons at high angle of attack).

When none of the above characteristics is abnormal, it will generally be satisfactory to assume 100% of the maximum loading from the symmetrical flight conditions acting on one side of the plane of symmetry and 75% of this loading acting on the other side.

Where outboard fins are attached to the horizontal tail surfaces, the tail surfaces shall be designed for the maximum horizontal surface loading in combination with the corresponding loads induced on the vertical surfaces by end-plate effects.

3.3.5.2 *Vertical tail surfaces.* Where outboard fins are attached to the horizontal tail surfaces, proper account shall be taken of the loads on the vertical tail surfaces due to yawing manoeuvres and gusts, in combination with the loads induced by end-plate effects.

3.3.5.3 *Tabs.* Trimming tabs shall be designed for the loads arising from all likely combinations of tab setting, primary-control position and aeroplane speed, obtainable both without exceeding the pilot effort assumed in the design of the control system (see 3.3.6) and without creating loads on the aeroplane exceeding those arising from the design conditions prescribed for the aeroplane as a whole.

NOTE: Compliance with the above requirement can normally be ensured by providing for the trimming loads occurring when the trim tab is deflected to the maximum which the pilot (human or automatic) can hold with the main control surface in any likely position. In the absence of specific data full tab deflection at speed V_D will need to be assumed.

Balancing tabs shall be designed for deflections consistent with the primary control surface loading conditions.

Servo tabs shall be designed for all deflections which are consistent with the primary control surface loading conditions and which can be achieved within the pilot effort (see 3.3.6) with due regard being given to possible opposition from the trim tabs.

3.3.6 *Control system loads.*

3.3.6.1 *Primary flight controls and systems.* The flight control system and supporting structure shall have sufficient strength to withstand loads corresponding with the maximum pilot effort in table 3–II with proper consideration being given to loads produced by automatic pilots or power assisted control systems. Alternatively, if a reliable estimate can be made of hinge moments of the control surfaces, assuming power assisted control systems if any, to be inoperative, design of the control system for loads corresponding with 1.25 times the maximum control surface hinge moments is acceptable provided that the control system shall have sufficient strength to withstand loads not less than those corresponding with the minimum pilot effort in table 3–II.

In any case, the loads assumed shall be such as to ensure a system sufficiently robust to provide for jarring, for taxying tail to wind, for the inertia and friction of the control system and for gusts encountered by the aeroplane while on the ground.

The loads due to pilot effort shall be assumed to act at the appropriate control grips or pads in a manner simulating operating conditions, and to be placed in equilibrium by an appropriate force at the attachment of the control system to the control surface horn.

Where a power assisted control system is installed, adequate strength shall be provided to withstand the manually applied loads which are likely to occur in the event of failure of the power source of the system.

3.3.6.2 *Dual controls.* Where dual controls are provided, the system shall have sufficient strength to withstand the loads applied by the pilots acting in opposition to each other. For this case, individual pilot effort equal to 75% of those prescribed in 3.3.6.1 shall be assumed, except that the individual pilot effort shall be not less than that corresponding with the minimum pilot effort in table 3–II.

Consideration shall also be given to the loads which would result from pilots acting together, particularly where a power assisted control system is installed, the failure of which would necessitate the use of high manual control forces.

3.3.6.3 *Aileron wheels.* In all the aileron wheel loading cases, the loads shall be applied tangentially to the rim of the wheel. In the aileron wheel torque case, the torque shall be produced by equal and opposite forces, applied tangentially at opposite sides of the wheel.

TABLE 3–II—PILOT EFFORT LIMITS FOR CONTROL SYSTEMS

Control	Maximum pilot effort	Minimum pilot effort
Aileron		
Stick lateral	36 kilograms (80 pounds)	18 kilograms (40 pounds).
Wheel lateral	36 kilograms (80 pounds)	18 kilograms (40 pounds).
Wheel vertical:		
Down	45 kilograms (100 pounds)	23 kilograms (50 pounds).
Up	45 kilograms (100 pounds)	23 kilograms (50 pounds).
Wheel torque	$36D$ kilogrammeters [1] ($80D$ inch pounds)	$18D$ kilogrammeters [1] ($40D$ inch pounds).
Elevator		
Stick	90 kilograms (200 pounds)	45 kilograms (100 pounds).
Wheel	113 kilograms (250 pounds)	45 kilograms (100 pounds).
Rudder		
Bar or pedals	135 kilograms (300 pounds)	60 kilograms (130 pounds).

[1] D equals the diameter of the control wheel in meters (inches).

3.4 *Ground loads; landplanes.* In these standards the landing gear is assumed to consist of two main wheel units near the centre of gravity, and one nose or tail wheel unit.

The aeroplane structure shall have sufficient strength to withstand the loads prescri' ed for the main landing conditions in 3.4.2 and taxying conditions in 3.4.3 at the design weights prescribed in 3.4.1.

The velocities of descent and landing conditions which are prescribed shall be modified appropriately to provide for unusual characteristics of the aeroplane, or for special landing techniques.

RECOMMENDATION: The strength of the structure to which the landing gear is attached should be greater than the strength of the landing gear, in order that the latter will fail before the former.

3.4.1 *Design weights.* The ground load standards shall be complied with at the following maximum weights:

(a) The design landing weight for the main landing conditions at the velocity of descent prescribed in 3.4.2.1.1;

(b) The design take-off weight for the main landing conditions at the velocity of descent prescribed in 3.4.2.1.2;

(c) The design take-off weight for the taxying conditions.

3.4.2 *Main landing conditions.* The aeroplane shall be assumed to make contact with the ground under the conditions prescribed in 3.4.2.1 to 3.4.2.5 inclusive.

3.4.2.1 *Velocity of descent.*

3.4.2.1.1 *At design landing weight.* The vertical velocity of descent v, associated with the design landing weight, shall be not less than:

where V_{s_0} is expressed in kilometers (miles) per hour, except that v shall not be less than 2.13 meters (7 feet) per second and need not be more than 3.05 meters (10 feet) per second (see fig. 3–5), where V_{s_0} is the stalling speed at design landing weight.

$$v \text{ in meters per sec.} = 1.52 + 0.0114 V_{s_0}$$
$$(v \text{ in feet per sec.} = 5.0 + 0.060 V_{s_0}).$$

If the fuselage has a margin of strength above that of the tail wheel unit such that failure would probably be confined to the tail wheel unit itself, the vertical velocity of descent for the design of the tail wheel unit may be reduced to not less than 0.8 times the above value.

3.4.2.1.2 *At design take-off weight.* The vertical velocity of descent associated with design take-off weight shall be at least 1.83 meters (6.0 feet) per second.

3.4.2.2 *Limit and ultimate landing load factors.* The limit landing load factors shall be not less than those which correspond with landings at the vertical velocity of descent v prescribed in 3.4.2.1.

The factor of safety of at least 1.5 shall apply in determining the corresponding ultimate landing loads. (See 3.4.2.3.2 for another ultimate load condition.)

3.4.2.3 *Energy absorption.*

3.4.2.3.1 *Limit energy absorption.* The energy absorbing properties of the landing gear shall be such that it will absorb

without bottoming the energy corresponding with the vertical velocity of descent v, prescribed in 3.4.2.1, unless such bottoming can occur without detriment to the continued safe functioning of the element affected.

3.4.2.3.2 *Reserve energy absorption.* The energy absorbing properties of the landing gear shall be such that it will absorb, without structural collapse of any part of the aeroplane, the energy corresponding with a vertical velocity of descent not less than $1.18v$. In establishing compliance with this standard the energy absorbed in distorting any part of the aeroplane structure may be taken into account.

3.4.2.3.3 *Proof of compliance.* The energy absorption characteristics of the landing gear shall be determined by drop tests, up to the vertical velocity of descent v, except that calculations may be made in lieu of tests for simple landing gear units, or for units similar to those for which test results are available. The characteristics at vertical velocities of descent in excess of v shall be determined by any suitable means.

3.4.2.4 *Drag loads.* The drag loads on the wheels shall be those necessary to accelerate the wheel in rotation, until there is no slipping between the tire and the ground when the aeroplane is landing at the vertical velocity of descent v and at a speed equal to $1.2V_{s_0}$. The coefficient of sliding friction between the tire and the ground shall have all values between zero and the maximum attainable, except that the maximum coefficient of sliding friction need not exceed 0.8.

NOTE 1: Attention is called to the possibility that transient stresses resulting from fore and aft, or torsional oscillations of the landing gear may be appreciable.

NOTE 2: In establishing equilibrium of the aeroplane as a whole, average values or suitable arbitrary values of drag load may be used. A suitable arbitrary value is 0.25 times the vertical load; the energy to be absorbed by the nose wheel shock absorber may then be determined on the basis of static equilibrium, if the relative stiffness of the nose and main shock absorbers justify this assumption.

3.4.2.5 *Landing cases.* Strength and energy absorption shall be investigated in the following landing cases. The aerodynamic lift on the aeroplane during the landing impact shall be assumed to be not greater than the weight of the aeroplane.

3.4.2.5.1 *Symmetrical landing cases; tail wheel type.* The aeroplane shall be assumed to land in the following attitudes:

(a) *Tail up.* The thrust line is approximately horizontal and the main wheels are in simultaneous contact with the ground.

(b) *Tail down.* The main and tail wheels are in simultaneous contact with the ground.

(c) *Tail clear.* The main wheels are in simultaneous contact with the ground and the tail wheel is just clear of the ground.

3.4.2.5.2 *Symmetrical landing cases; nose wheel type.* The aeroplane shall be assumed to land in the following attitudes:

(a) *Tail up.* The main and nose wheels are in simultaneous contact with the ground.

(b) *Nose clear.* The main wheels are in simultaneous contact with the ground and the nose wheel is just clear of the ground.

(c) *Tail down clear.* The aeroplane is either in the stalling attitude, or in the attitude of maximum angle of attack permitting clearance of the ground by the tail structure, whichever attitude gives the smaller angle of attack.

Unless the general arrangement of the aeroplane is such that the likelihood of the tail structure making contact with the ground is extremely remote, the structure shall have sufficient strength to withstand the loads imposed by such contact. In selecting the vertical velocity of descent for tail contact, the probable frequency of occurrence shall be taken into account.

3.4.2.5.3 *Asymmetrical landing cases*—(a) *Landing on one main wheel unit.* The aeroplane shall be assumed to land so that the main landing wheel unit on one side only of the aeroplane is in contact with the ground.

NOTE: In the absence of a more rational investigation, the ground loads on the wheel unit in contact with the ground may be assumed to be the same as those occurring on the one side in case (a) of 3.4.2.5.1 or case (b) of 3.4.2.5.2. Unbalanced moments will need to be placed in equilibrium with appropriate moments due to inertia forces.

(b) *Lateral drift landings.* The aeroplane shall be assumed to land with side drift such that the side load at each wheel unit is equal to at least 0.25 times the vertical load obtained in case (a) of 3.4.2.5.1 or 0.25 times the vertical loads obtained in cases (a) and (b) of 3.4.2.5.2. This side load shall be assumed to occur in combination with the vertical loads and drag loads of these cases, except that if a side load equal to 0.3 times the maximum vertical load is used it need only be combined with 0.5 times the maximum vertical load and zero drag load.

For castoring wheels, the side loads need not exceed those necessary to rotate the landing gear units about the castor axis, allowance being made for the effects of inertia, self-centering devices, anti-shimmy devices, bearing friction, and incorrect adjustment. In estimating the side load occurring on a castoring unit, the wheel unit shall be assumed to be yawed to an agle of 6° at the instant of impact with the ground.

3.4.3 *Taxying conditions.* It shall be demonstrated that the shock absorbing characteristics and strength of the aeroplane are satisfactory, by conducting operating trials of the aeroplane on ground simulating the roughest on which operation is intended.

The design cases prescribed in 3.4.3 shall be investigated, with wing lift assumed to be zero.

Consideration shall also be given to the necessity of amplifying, or increasing the severity of, these design cases to provide for unusual characteristics of the aeroplane and for unusual operating techniques.

3.4.3.1 *Braked run.* The aeroplane shall be assumed to be in the tail up attitude. The vertical load factor shall be not less than 1.0. A drag reaction shall be applied at the ground contact point of each wheel equipped with brakes. The drag reaction shall be 0.8 times the vertical reactions, but need not exceed the value corresponding with the maximum obtainable brake torque.

NOTE: Where the maximum obtainable brake torque is appreciably lower than that corresponding to a drag reaction of 0.8 times the vertical reaction, it may be necessary to increase the factor of safety above 1.5 to provide a sufficiently robust design.

RECOMMENDATION: The dynamic effects of pitching resulting from rapid application of the brakes should be taken into consideration.

3.4.3.2 *Turning and swinging.* The aeroplane shall be assumed to be subjected to the loads occurring when the aeroplane taxies in a curved path and only the main wheels are in contact with the ground, the load factors at the centre of gravity being not less than 1.0 vertically and 0.5 laterally.

For aeroplanes likely to develop a swing (i. e., having a tendency to ground loop), the lateral load factor shall be suitably increased but need not exceed a value of 0.6.

In distributing the loads between the wheels on the two sides of the aeroplane, the rolling moments due to inertia forces shall be considered to be zero.

The ratio of the side load to the vertical load at each wheel shall be equal to the ratio of the lateral load factor to the vertical load factor.

3.4.3.3 *Nose and tail wheels.* Nose and tail wheel units and their supporting structure shall have sufficient strength to withstand vertical and side loads appropriate to ground maneuvers normally encountered by aeroplanes of the particular type.

RECOMMENDATION: In demonstrating compliance with this standard, at least the following design conditions should be investigated:

(a) *Nose wheel yawing loads.* A vertical load factor of 1.0 at the aeroplane centre of gravity and a side component at the nose wheel ground contact point equal to 0.8 times the vertical ground reaction should be assumed. The vertical wheel reactions should be determined assuming static equilibrium.

(b) *Tail wheel yawing loads*—(i) *Wheel trailing.* Where a lock, steering device, or shimmy damper is fitted, a vertical ground reaction equal to the static load on the tail wheel, combined with a side load equal to 0.5 times the vertical load, should be assumed to act at the ground contact point of the wheel, except that, if means are provided to limit the torque about the castoring axis, the side load need not exceed that permitted by such means.

(ii) *Wheel castored through 90 degrees.* A vertical ground reaction equal to the static load on the tail wheel, combined with a side load (perpendicular to the plane of symmetry of the aeroplane) equal to 0.5 times the vertical load, should be assumed to act through the axle.

(c) *Tail wheel obstruction load.* A vertical ground reaction equal to 1.5 times the static load on the tail wheel, combined with a drag component equal to 0.66 times the vertical ground reaction, should be assumed to act through the axle, the wheel being in the trailing position.

3.5 *Ground loads; skiplanes (recommendations).*

3.5.1 *Landing conditions.* The landing conditions for skiplanes should be as prescribed for landplanes in 3.4 to 3.4.2.5.3 inclusive, except that the drag loads should be as prescribed in 3.5.

If the shock absorbing characteristics are known (e. g., from tests on landplane landing gear), compliance with these recommendations can be shown by calculations.

The loads occurring in the level, tail down, and one ski landing attitudes should be applied as follows:

(a) The vertical load on each ski should be assumed to act through the centerline of the pedestal bearing and the centerline of the ski;

(b) In the tail up and one ski landing conditions, a drag load equal to 25% of the vertical load should be applied at the centerline of the pedestal bearing.

3.5.2 *Taxying conditions.*

3.5.2.1 *Turning and swinging.* The attitude and the loads should be those given in 3.4.3.2 for a wheel type landing gear. The side load should be applied at the ski bottom, directly under the pedestal bearing. The vertical load should be applied at the centerline of the pedestal bearing.

3.5.2.2 *Torque load.* To provide adequate strength for normal landing, taxying and ground handling conditions, a torque equal to $0.203W$ kilogrammeters where W is quoted in kilograms ($0.667W$ foot pounds where W is quoted in pounds), should be applied about the vertical axis through the centerline of one main pedestal bearing, where W is the design take-off weight of the aeroplane.

3.5.3 *Skis.* Skis and ski pedestals should be approved for a maximum static load P determined on the basis of the following recommendations.

3.5.3.1 *Strength.* The strength of a ski, its pedestal, cables, lugs and mechanical trimming gear, should be substantiated by calculations or by static tests.

3.5.3.2 *Design loads.* When supported at the pedestal bearing, a ski and its pedestal should be capable of carrying the following loads. The factor of safety of at least 1.5 should be applied.

3.5.3.2.1 *Distributed up loads.* A distributed up load Pn should be applied to the ski bottom and should be distributed uniformly across the ski and extending uniformly from the rear of the ski as far forward as is necessary to bring the center of pressure at a point one-quarter of the height of the pedestal ahead of the pedestal bearing, where:

P= the maximum static load in kilograms (pounds) for which approval is sought, and

$$n=2.80+\frac{4,080}{2P(\text{kg.})+1,815}$$

$$\left(n=2.80+\frac{9,000}{2P(\text{lbs.})+4,000}\right)$$

(See also fig. 3-6)

Equilibrium about the pedestal bearing sleeve should be obtained by applying at the ski bottom a drag load equal to 25% of the vertical load.

3.5.3.2.2 *Concentrated up loads.* Concentrated up loads should be applied at the extreme ends of the ski, the sum of these loads being equal to $1.33P$, and the direction of application being perpendicular to the ground line, the total moment about the axle being zero.

3.5.3.2.3 *Distributed side load.* A uniformly distributed side load should be applied to the side of the skis, symmetrically disposed with respect to the pedestal bearing in the fore and aft direction. The load on each ski should be 35% of the load used in 3.5.3.2.1.

3.5.3.2.4 *Torque load.* A torque load equal to $0.405P$ kilogrammeters where P is quoted in kilograms ($1.33P$ foot pounds where P is quoted in pounds), should be applied to the ski about the vertical axis through the centerline of the pedestal bearing.

3.5.3.3 *Restraining and trimming gear.* An elastic trimming gear should be provided to maintain the ski in an appropriate position during all approved flight conditions. It should have sufficient strength to withstand the maximum aerodynamic and inertia loads sustained by the ski. If information concerning the magnitude of such loads is not available, the gear should be designed for a pitching moment of at least $0.0405W$ kilogrammeters ($0.133W$ foot pounds) applied about the pedestal bearing in either direction, where W is the weight in kilograms (pounds) of the aeroplane.

A restraining gear should be provided to limit positively the angular travel of the ski to values corresponding with the positions assumed by the ski when:

(a) The aeroplane encounters an uphill slope, when in a tail up attitude;

(b) The aeroplane encounters a downhill slope, when in a tail down attitude.

NOTE: It will usually be sufficient to assume that the angle of these slopes is 7½ degrees. The total angular travel of the ski will thus be the landing angle (i. e., the angle between the tail up and tail down attitudes) plus 15 degrees.

This angular travel should be provided with the shock absorber both fully extended and fully compressed. The restraining gear, and the structure to which the restraining gear is attached, should have sufficient strength to withstand a vertical load equal to 0.8 times the static vertical load on the ski, applied firstly at the fore end of the ski and, secondly, at the aft end of the ski.

3.5.4 *Ski selection.* The maximum static load on a ski installed in the aeroplane should not exceed the static load P for which the ski has been approved. When the load factor resulting from the recommended landing conditions exceeds the value of n recommended in 3.5.3.2.1, this fact should be properly taken into account in selecting skis.

3.6 *Water loads.* (Reserved.)

3.7 *Emergency landing conditions.* The standards of 3.7 relate to emergency landing, in which the safety of the occupants shall be considered, although damage may be suffered by the aeroplane itself.

3.7.1 *Inertia loads.* The design of the aeroplane shall be such that there will be every reasonable chance that the occupants (passengers and crew) will escape serious injury in the event of an emergency landing (including the case of wheels retracted if applicable), when they are subjected to inertia forces of the following magnitude (expressed in terms of acceleration) and direction relative to the aeroplane:

$4g$ downwards to $2g$ upwards;
zero to $6\ g$ forwards;
zero to $1.5g$ sideways.

So far as is practicable any items which might break loose shall be positioned so that they are unlikely to cause injury to the occupants or nullify any of the escape facilities provided for use after an emergency landing. Where such positioning is not practicable, the attachments and the surrounding structure shall be designed to withstand inertia forces corresponding with the accelerations prescribed.

All loads corresponding with the prescribed accelerations are "ultimate" (i. e., the factor of safety of 1.5 is included), and the corresponding limit loads need not be considered.

NOTE: Detail design standards for seats, berths, and safety belts are given in 4.6.

3.7.2 *Turn-over.* The structure of the aeroplane shall be designed to protect the occupants in the event of a complete turn-over, except when the general arrangement of the aeroplane renders the possibility remote.

3.7.3 *Emergency alighting on water.* These standards apply to aeroplanes used in certain circumstances as defined in the standards of annex 6.

The design of the aeroplane shall be such that:

(a) So far as practicable, the behaviour of the aeroplane in a premeditated forced alighting on water will be unlikely to cause immediate injury to the passengers, or to make their escape impossible;

(b) The aeroplane, after such forced alighting on water, is likely to remain afloat for a period long enough to permit all the occupants to leave their normal stations and escape from the aeroplane.

RECOMMENDATION: The following procedures for showing compliance with the standards for emergency alighting on water should be followed:

The probable behaviour of the aeroplane should be investigated by model tests or by comparison with aeroplanes of similar design, for which the characteristics in emergency alighting are known. In making such tests or comparisons, proper consideration should be given to scoops, wings, wing flaps, projections, and all other factors likely to affect the hydrodynamic characteristics of the aeroplane under consideration. External doors and windows should be designed to withstand the probable maximum local pressures, unless the effects of the collapse of such parts are taken into account in the model tests or aeroplane comparison.

Compliance with flotation standards can be demonstrated by buoyancy and trim computations, in which suitable allowances are made for probable leakage and structural damage.

For aeroplanes equipped with a fuel jettisoning system, the volume of the space occupied by the jettisoned fuel can be considered as buoyancy volume.

3.8 *Flutter prevention and stiffness.* The aeroplane shall be designed so as to be free from flutter of wing and tail units,

all control and trim surfaces included, and of divergence (i. e., unstable structural distortion due to aerodynamic loading) at all speeds up to $1.2V_D$, except that the margin of speed over V_D may be reduced if the characteristics of the areoplane (including the effects of compressibility) render this higher speed unlikely to be achieved and if the investigations prove a satisfactory margin of safety to exist at speed V_D.

NOTE: In the absence of better information the estimated terminal velocity in a dive of 30° to the horizontal may be considered to be the likely maximum.

Allowance shall be made for any variations which may occur in service due to wear, icing, etc., or between one areoplane and another, and for any reductions in effective stiffnesses (e. g., of wings) which may occur due to loading within the limit conditions.

Compliance with these standards shall be shown by calculations, resonance tests, and other tests, except that these calculations and tests may be waived if previous experience or adequate information shows that they are not necessary in any particular case. Calculations or tests shall be based upon a rational analysis of the prescribed conditions; simplified design criteria may be used for conventional aeroplanes, provided that there is sufficient information to show that such criteria will ensure at least the prescribed leve. of safety.

NOTE: The following simplified criteria are suitable for conventional monoplanes. (Conventional monoplanes are monoplanes with wings of conventional taper and sweep back, position of flexual axis and mass distribution, and equipped with directly operated control surfaces and, if any, with tabs not increasing the number of degrees of freedom.)

To make allowance for compressibility effects each criterion includes a multiplying factor $(1-M^2)^{1/4}$ where M is the Mach number corresponding to speed V_D. The evidence on which this multiplying factor is based extends to values of M of 0.8, but not above 0.6 in the case of large aeroplanes:

(a) *Wing stiffness*—(i) *Wing torsional stiffness.* The torsional stiffness criterion of the wings at the 0.75 semi-span section,

$$\frac{1}{V_D}\left(\frac{m_e}{\rho_0 dc^2}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

will need to be not less than the appropriate value given in table 3–III.

TABLE 3–III

Wings without wing-engines: $0.49+0.0188\ \rho_w/\rho_0$ or 0.74 whichever is the smaller.

Wings with wing-engines the centers of gravity of which are ahead of the wing leading-edge, and outboard 0.25 of the semi-span; and with ρ_w/ρ_0 less than 26: 0.57.

For wings with wing-engines the centers of gravity of which are aft of the wing leading-edge, and for wings with ρ_w/ρ_0 exceeding 26 no simple criterion is available.

Where:

m_e = the torque required per radian of torsional deflection of the wings measured at the 0.75 semi-span section when concentrated torque loads are applied at the 0.75 semi-span section on each side of the aeroplane simultaneously, in either the same or opposite sense. The torsional deflection will need to be measured with respect to the centerline of the aeroplane;

d = distance from wing root to 0.9 semi-span section;

c = geometric mean chord of wing based on gross wing area;

ρ_0 = density of air at sea level in the Standard Atmosphere (see value in Part I, para. 1, "Standard Atmosphere").

All distances and sections are taken to be either parallel or normal to the mid-chord line of the wing;

$$\rho_w/\rho_0,\ \text{wing density ratio}=\frac{M_1+0.5M_2}{\rho_0 S_1 c_1},$$

where:

S_1 = area of wing outboard of face of fuselage;

c_1 = geometric mean chord of wing defined by area S_1;

M_1 = mass of wing structure, including wing control surfaces, etc., in the area S_1;

M_2 = mass of load, other than structure, carried on the wing of area S_1.

(ii) *Wing-tip torsional stiffness.* The torque required per radian of torsional deflection of the wings, measured at the 0.9 semi-span section, when concentrated torque loads are applied at the 0.9 semi-span section on each side of the aeroplane simultaneously, in either the same or opposite sense, will need to be not less than 40% of the required value of m_e. The torsional deflection will need to be measured with respect to the centerline of the aeroplane.

(b) *Aileron torsional stiffness.* The torsional stiffness criterion for the ailerons

$$\frac{1}{V_D}\left(\frac{T_a}{\rho_0 b_a c_a^2}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

will need to be not less than the appropriate val--- given in table 3–IV.

TABLE 3–IV

Location of mass balance, or of irreversible or damped control unit attachment and criterion

One or two concentrated masses or the control attached at one or two points along the span: $0.37\ (d_a/b_a)^{1/2}$.

More than two concentrated masses evenly spaced along the span or the control attached at more than two points evenly spaced along the span: 0.185.

More than two concentrated masses unevenly spaced along the span or the control attached at more than two points unevenly spaced along the span: 0.185 or $0.37\ (d_a/b_a)^{1/2}$ whichever is the greater.

Mass balance distributed along the span: 0.185.

Where:

T_a = the torque required per radian of torsional deflection measured between sections at right angles to the hinge line $0.1b_a$ from the inner and outer ends of the aileron when concentrated torque loads, equal in magnitude but acting in opposite sense, are applied at these defined sections;

b_a = span of aileron measured parallel to the hinge line.

c_a = geometric mean chord of aileron area aft of the hinge line.

For ailerons with a single concentrated mass balance:

d_a = distance between the mass balance and the more remote tip of the aileron.

For ailerons with two or more concentrated mass balances:

d_a = distance between each tip of the aileron and the adjacent mass balance, or half the greatest distance between adjacent mass balances, whichever is the greater.

(Where irreversible or damped controls are used instead of mass balancing, the distance d_a is measured with respect to the point(s) of attachment of the control.)

(c) *Fuselage stiffnesses.* The stiffness criteria, defined below, for the fuselage will need to be not less than the appropriate values given in table 3–V.

TABLE 3–V

Fuselage in flexure about lateral axis	2.46
Fuselage in flexure about vertical axis	2.86
Fuselage in torsion	.74

(i) *Flexural criterion about lateral axis.*

$$\frac{1}{V_D}\left(\frac{F_{f_v}}{\rho_0 l'S'}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

F_{f_v} = the moment about the wing root quarter chord point of the concentrated vertical load necessary at the elevator hinge line per radian of deflection of the elevator hinge line about the wing root quarter chord point, assuming the fuselage supported at the wing roots;

l' = distance between wing root quarter chord point and elevator hinge line;

S' = area of horizontal tail surface (including elevator).

(ii) *Flexural criterion about vertical axis.*

$$\frac{1}{V_D}\left(\frac{F_{f_l}}{\rho_0 l''S''}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

F_{f_l} = the moment about the wing root quarter chord point of the concentrated horizontal load necessary at the rudder hinge line per radian deflection of the rudder hinge line about the wing root quarter chord point, assuming the fuselage supported at the wing roots;

l'' = distance between wing root quarter chord point and the rudder hinge line;

S'' = area of vertical tail surface(s), including rudder(s).

(iii) *Torsional criterion.*

$$\frac{1}{V_D}\left(\frac{T_f}{\rho_0 s'S'}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

T_f = the torque required per radian of torsional deflection of the fuselage measured between the wing root quarter chord point and the elevator hinge line, when a concentrated torque is applied to the fuselage at the elevator hinge line and the fuselage is suitably supported at the roots of the wing spars;

s' = semi-span of horizontal tail surface;

S' = total area of horizontal tail surface (including elevator).

(d) *Stiffness of tail surfaces.* The stiffness criteria, defined below, for the tail surfaces, will need to be not less than the appropriate values given in table 3–VI.

TABLE 3–VI

Horizontal fixed surface in torsion:	
With outboard fins and rudders	0.92
Without outboard fins and rudders	.72
Elevator in torsion:	
Without aerodynamic horn balance	.246
With aerodynamic horn balance	.286
Rudder in torsion	.226
Elevator overhang in flexure: (portion outboard of outermost hinge)	1.85

(i) *Horizontal fixed surface torsional criterion.*

$$\frac{1}{V_D}\left(\frac{T_t}{\rho_0 s' c_t^2}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

T_t = torque required per radian of torsional deflection of tail measured between the horizontal fixed surface root and a section at 0.8s' from the centerline of the aeroplane, when a concentrated torque load is applied at the section;

s' = semi-span of horizontal tail surface;

c_t = geometric mean chord of horizontal tail surface (including elevator).

(ii) *Elevator torsional criterion.*

$$\frac{1}{V_D}\left(\frac{\overset{1}{T_e}}{\rho_0 b_e c_e^2}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

T_e = torque required per radian of torsional deflection of elevator measured between sections 0.05b_e from the left and right tips of the elevator, when concentrated torque loads acting in opposite sense are applied at the defined elevator sections;

b_e = over-all span of elevator;

c_e = geometric mean chord of elevator aft of the hinge line.

(iii) *Rudder torsional criterion.*

$$\frac{1}{V_D}\left(\frac{T_r}{\rho_0 b_r c_r^2}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

T_r = the torque required per radian of deflection of rudder measured between sections 0.1b_r from the upper and lower ends of the rudder, when concentrated torque loads acting in opposite sense are applied at the defined rudder sections;

b_r = over-all height of rudder measured parallel to the hinge line;

c_r = geometric mean chord of the rudder aft of the hinge line.

(iv) *Elevator overhang flexural criterion.*

$$\frac{1}{V_D}\left(\frac{F_e}{\rho_0 d' S_e}\right)^{\frac{1}{2}}(1-M^2)^{\frac{1}{4}}$$

Where:

F_e = the moment about the outermost hinge of the concentrated vertical load necessary at the elevator tip per radian of deflection of the tip about the hinge;

d' = distance from outermost hinge to tip of elevator;

S_e = area of elevator outboard of outermost hinge.

(e) *Control system stiffness.* Compliance with the following will need to be established by test. Where the control system incorporates cables, these will need to be slackened for the purpose of the test, so that any tension in them is inappreciable compared with the minimum tension which would be regarded as satisfactory for flight. If the cables are slackened to an extent such that the application of small loads produces abnormally large displacements, the initial curved portion of the load/displacement curve may be disregarded in estimating the control system stiffness.

(i) *Percentage stretch.* The percentage stretch of each control system will need to be not greater than 20, when the load applied by the pilot equals one-half of the maximum limit load prescribed for the design of the system. The percentage stretch is defined by 100a/A.

where:

A = the mean available movement of the cockpit control from the central position when the control surface is free;

a = the comparable movement of the cockpit control when the pilot force is resisted by loads at the control surfaces which maintain the surfaces in their zero settings.

(ii) *Aileron control system.* In addition, the aileron control system needs to be such that, when the ailerons are loaded symmetrically so that no movement of the control column or wheel occurs, the change of hinge moment per radian of angular deflection at the point of attachment of the circuit to the control surface is not less than:

$$T+\frac{2n_1}{3}wS_a c_a$$

Where:

n_1 = load factor specified in 3.3.1.2;

T = 138 kilogrammeters (1,000 foot pounds);

w = wing loading corresponding with the maximum weight of the aeroplane;

S_a = aileron area aft of hinge line;

c_a = mean chord of aileron aft of hinge line.

This criterion was developed for Frise type ailerons. Seventy-five percent of the stiffness corresponding with this criterion is satisfactory for plain ailerons.

(f) *Aileron mass balance.* Each aileron needs to be balanced so that, at all angles of the aileron between ±10°, when the center of gravity of the aileron, including the control surface, tabs, control levers and any other attachments directly connected to the aileron, is in its most aft position, the product of inertia of the aileron, Σmxy, is zero or negative, where:

m = element of aileron mass;

x = distance of mass m from hinge line, measured normal to hinge line and in plane of wing (positive when behind axis);

y = distance of mass m from a longitudinal axis, usually coincident with wing root, (but subject to variation if the inboard portion of the wing is abnormally stiff) measured normal to this axis and in plane of wing.

In addition to the mass balance described above, consideration needs to be given to the desirability of bringing the most aft position of the center of gravity of the aileron (including all attached parts) on or just ahead of the hinge line, if flutter might develop from wing modes with nodal lines outboard of the fuselage, as may be the case with strutted wings and wings with wing engines.

(g) *Rudder and elevator mass balance.* Each rudder and each half of the elevators, including both the control surface itself and the tabs, control levers and any other attachments directly connected to the control surface, needs to be balanced so that, at all rudder and elevator angles between ±10°, the following conditions of (i), (ii) and (iii) are achieved. When mass balance weights are connected to the surface through a linkage system, attention needs to be given to all possible modes of flutter and to the positions of the nodal lines;

(i) For aeroplanes with speed V_D greater than 240 km. p. h. (150 m. p. h.) *EAS*, the center of gravity of the control surface needs to be not more than 0.05c_e in the case of elevators, and 0.05c_r in the case of rudders, forward of the hinge line when the center of gravity is in its most forward position, and aft of the hinge line when the center of gravity is in its most aft position;

(ii) For aeroplanes with a speed V_D up to 240 km. p. h. (150 m. p. h.) *EAS*, the center of gravity of the control surface needs to be not more than 0.15c_e in the case of elevators, and 0.15c_r in the case of rudders, forward of the hinge line when the center of gravity is in its most forward position, and aft of the hinge line when the center of gravity is in its most aft position;

(iii) For all aeroplanes, when the center of gravity of the control surface is in its most aft position, the product of inertia, Σmxy, needs to be zero or negative where:

m = element of rudder or elevator mass;

x = distance of mass m from hinge line measured normal to hinge line and in the plane of the surface (positive when behind hinge line);

y = distance of mass m from the fuselage axis of torsion, measured normal to this axis, in the plane of the surface. In conventional rudders with most of the mass above the fuselage torsional axis, the y dimension is treated as positive if the mass m is above torsional axis.

3.9 *Loss of control due to structural deformation.* The aeroplane shall be designed so as to be free from control reversal and from undue loss of longitudinal, lateral, and directional stability and control, due to structural deformation at all speeds up to 1.2V_D or up to such lower speed as complies with 3.8. Compliance with 3.9 shall be established by calculations substantiated, where necessary, by structural tests or by the use of other methods where these have been demonstrated to be satisfactory.

NOTE: Besides distortion of main components "structural deformation" includes the deformation of lesser parts and of skin panels. The deformation of these latter, particularly on the control surfaces, due to air loading or internal pressure, may lead to dangerous variations of hinge moment.

3.10 *Vibration and buffeting.* The aeroplane shall be designed so as to prevent deleterious vibration and deleterious buffeting. Adequate strength shall be provided to withstand the vibration and buffeting which may occur in any likely operating condition.

3.11 *Fatigue strength.* The strength and fabrication of the aeroplane shall be such as to ensure that the probability of disastrous fatigue failure of the aeroplane structure under repeated loads anticipated in operation is extremely remote during the expected life of the aeroplane or parts thereof. Where a type of construction is used for which experience is not available to show that compliance with other standards of Chapter 3 will ensure the strength of the structure under repeated loads, its strength under such loads shall be substantiated by suitable investigations.

NOTE: In showing compliance with this standard it is suggested that consideration be given to establishing a "limit lifetime" for parts of the aeroplane structure in which incipient or progressive fatigue failure could not be easily detected by inspection in time to avoid disastrous fatigue failure or serious reduction of the static strength of the structural component.

The best possible assumptions of the magnitude and the number of repetitions of loads to be anticipated from gusts, manoeuvres, ground loads, and vibration, will be necessary.

"Fatigue factors" of safety will need to be applied to the estimated spectrum of load magnitude versus repetitions, to ensure that fatigue failure of such a part is fully pre-

vented during its limit lifetime, consideration being given to the use of two fatigue factors of safety: one on the magnitude of the repeated loads, and the other on the number of repetitions, i. e., on lifetime.

The order of magnitude of these fatigue factors is suggested to be 1.2 for the first and from 2 to 3 for the second, depending upon the reliability of available information as regards load spectrum and variation in the fatigue qualities of the part as well as the extent to which fatigue tests are made.

3.12 *Handling loads.* Where provision is made for towing, jacking, etc., the strength provided shall be sufficient for the uses recommended by the designers.

NOTE: Attention is drawn to the desirability of indicating near each such point the uses which may be made of it.

CHAPTER 4—DESIGN AND CONSTRUCTION

4.1 *General.*

NOTE: In general, the standards of Chapter 3 deal with structural strength and stiffness and those of Chapter 4 deal with other aspects of design and construction essential to airworthiness. However, there are exceptions to this arrangement, and care is needed to ensure that the standards of both chapters are met for any particular part of the aeroplane.

Where there is doubt as to the suitability or reliability of any detail of design or construction, tests shall be conducted to demonstrate such suitability or reliability.

The functioning of all moving parts essential to the safe operation of the aeroplane shall be demonstrated by suitable tests in order to ensure that they will function correctly under all foreseable operating conditions.

4.1.1 *Materials.* All materials used in parts of the aeroplane essential for its safe operation shall conform to approved specifications. The approved specifications shall be such that materials accepted as complying with the specifications will have the essential properties assumed in the technical investigations associated with the design calculations. The suitability and durability of such materials shall be established by experience or by tests.

4.1.2 *Fabrication methods.* The methods of fabrication employed shall be such as to produce a consistently sound structure. When a fabrication process requires close control to attain this objective, the process shall be performed in accordance with an approved specification.

4.1.3 *Locking of connections.* An approved locking means shall be used on all connecting elements in the structure, fluid systems, control and other mechanical systems, essential to the safe operation of the aeroplane.

NOTE: This standard is not intended to demand an additional locking device when the type of connecting element has itself been proved entirely suitable, by service experience or by test, for the conditions in which it is employed.

4.1.4 *Protection.* The structure shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes.

4.1.5 *Inspection provisions.* Adequate provision shall be made to permit the examination of those parts of the aeroplane which require periodic inspection.

4.2 *Control systems.*

4.2.1 *General.* All controls shall be capable of operation with sufficient ease, smoothness, and positiveness to permit the proper performance of their function. They shall be arranged and identified so as to provide satisfactory convenience in operation and to minimize the possibility of confusion and inadvertent operation.

Where practicable, the sense of motion involved in the operation of all controls for which the standards do not prescribe specific directions of movement shall correspond with the sense of the response either of the aeroplane or, if the aeroplane response is relatively unimportant, of the part operated.

The controls shall be located and arranged with respect to the appropriate flight crew member seats so that full and unrestricted movement of each control will be possible without interference from flight crew compartment structures or from the clothing of the crew when seated. Compliance with this standard shall be demonstrated for individuals of various sizes.

4.2.2 *Primary flight controls.* Primary flight controls are defined as those used by the pilot for the immediate control of the pitching, rolling, and yawing of the aeroplane.

When the primary flight controls consist of a control stick in front of each pilot, or of a column providing a grip or wheel in front of each pilot, and a pair of foot pedals for each pilot, these controls shall operate as follows:

(a) A forward displacement of the top of the stick, grip, or wheel shall cause the aeroplane to pitch nose down;

(b) A displacement of the stick or grip towards the right, or a right-hand rotational displacement of the wheel, shall cause the aeroplane to bank right wing down;

(c) A forward displacement of the right-hand rudder pedal shall cause the aeroplane to turn to the right.

4.2.3 *Trimming controls.* Trimming controls, and the means provided for indicating the position of trimming devices, shall be arranged so that they will not give a misleading impression to the pilot as to the aeroplane motion which will result from a particular movement of the controls.

NOTE: Each trimming control may be arranged to operate in the plane, and with the sense of the motion of the aeroplane which its operation is intended to produce.

Suitable precautions shall be taken to minimize the possibility of dangerously abrupt operation of trimming devices.

Means shall be provided to indicate to the pilot the direction in which the control must be moved in order to produce the desired direction of motion of the aeroplane, and to indicate the position of the trimming device. In the case of aileron trimming controls, the means of indicating the position of the trimming device may be omitted if it is shown that no unsafe flight condition could result from setting the control in any position.

RECOMMENDATION: The indicating means preferably should be adjacent to the controls.

Where trimming tabs are used, their controls shall be irreversible unless the tab is suitably balanced to prevent flutter. Particular care shall be taken to provide a high degree of rigidity, of reliability, and of freedom from lost motion, in the portion of the system from the tab to the attachment of the irreversible unit to the aeroplane structure.

RECOMMENDATION: The trimming control system should be independent of the primary flight control system.

4.2.4 *Wing flap controls.* The wing flap control and position indicating means shall be such as to enable the flight crew to place the wing flaps readily and surely in any position used in showing compliance with the performance standards. The position shall be maintained without further attention on the part of the flight crew, except in the case of an automatic wing flap positioning device.

The rate of movement of the wing flaps, after the selection by the pilot of any required wing flap position, shall be such that there is no change in lift, drag, or trim, which would cause undue difficulty in controlling the aeroplane. This standard shall be complied with at all engine power conditions.

The characteristics of automatic wing flap operating devices shall be shown to be such that wing flap movement under changing conditions of airspeed, engine power, or aeroplane attitude, would not result in any hazardous flight conditions, or in failure to meet the appropriate flight standards.

4.2.4.1 *Wing flap interconnection.* The motion of the wing flaps on opposite sides of the plane of symmetry shall be synchronized by mechanical or other reliable means unless the aeroplane is demonstrated to have safe flight characteristics while the wing flaps are fully extended on one side and fully retracted on the other (see 3.3.2.4 for asymmetrical loads).

4.2.4.2 *Wing flap position indicators.* Means shall be provided to indicate the wing flap position to the pilot. The wing flap position indicator shall show the take-off, en route, approach, and landing postitions. If any extension beyond the landing position is possible, the wing flap position indicator shall be clearly marked to identify such extension.

4.2.5 *Control system installations.* All control systems and operating devices shall be designed and installed so as to prevent jamming, chafing, interference by passengers, cargo, or loose objects, and slapping of cables, chains, or tubes against parts of the aeroplane. Compliance with this standard shall be demonstrated by suitable tests.

All pulleys and sprockets shall be provided with satisfactory guards.

4.2.5.1 *Stops.* The range of motion of the control surfaces and of the pilots' controls shall be limited by stops. These stops shall be capable of withstanding the loads corresponding with the design conditions for the control system. Motion due to flexibility, beyond the limits established by the stops, shall be kept to a minimum.

4.2.5.2 *Control system locks.* Where a device is provided in the aeroplane for

locking a control surface while the aeroplane is on the ground or water, the locking device shall be installed so that while it is engaged it will provide to the pilot unmistakeable warning which it is impossible for him to ignore. Means shall be provided to preclude the possibility of the lock becoming engaged during flight.

4.2.5.3 *Incorrect assembly.* Control systems shall be designed so as to minimize the risk of incorrect assembly.

NOTE: It is suggested that attention be given to the possibility of designing the connections, especially those used during maintenance, so as to render reversal of any system or misconnection between systems, a physical impossibility.

4.3 *Landing gear.*

4.3.1 *Retracting systems.* All retractable units of a landing gear shall comply with 4.3.1, except that tail wheel units need not comply if it is clear that incorrect functioning of such units would not be dangerous.

4.3.1.1 *Operating conditions.* The retracting mechanism shall have sufficient power to retract and to extend the landing gear at all speeds from stalling speed to a speed providing a safe margin above the stalling speed with wing flaps retracted, when the aeroplane is subjected to accelerations likely to be encountered.

NOTE: The following conditions are appropriate:

(a) Airspeed—from V_{s_0} to $1.6V_{s_1}$, where V_{s_1} is the stalling speed with wing flaps in the approach position, at design landing weight.

(b) Accelerations — corresponding with aeroplane load factors from 0.8 to 1.3.

RECOMMENDATION: Where other than manual operation of the landing gear is employed the retracting mechanism should be such that if the movement of the landing gear is arrested during retraction and extension by transient accelerations outside the selected limits, it should recommence as soon as the acceleration conditions are again within the limits and the operation should then be completed automatically without further attention.

4.3.1.2 *Strength conditions.* When the landing gear is locked in the retracted position it shall comply with the flight load standards prescribed for the aeroplane as a whole. When the landing gear is locked in the extended position, it shall comply with the ground load standards prescribed for the aeroplane as a whole.

In addition, the retracting mechanism and its supporting structure shall have sufficient strength to withstand the critical combinations of loads resulting from the following:

(a) All landing gear positions, other than the locked retracted position;

(b) All airspeeds within the limits selected in accordance with 4.3.1.1;

(c) The aeroplane load factors prescribed in 3.3.2.1;

(d) The loads imposed by the power source of the retracting mechanism;

(e) The inertia loads resulting from the sudden stopping of wheel rotation by brakes.

4.3.1.2.1 *Landing gear doors.* Landing gear doors, their operating mechanism, and their supporting structure, shall be designed for the conditions of airspeed and load factor prescribed for the landing gear, and shall also have sufficient strength to withstand the yawing manoeuvres and lateral gust prescribed for the aeroplane as a whole, while the aeroplane is flying at all speeds up to the landing gear operating speed or the landing gear extended speed, whichever is appropriate.

4.3.1.3 *Locking of landing gear.* Reliable means shall be provided to lock the landing gear in the extended position. Reliable means shall also be provided to lock the landing gear and its doors in the retracted position, unless it is established that inadvertent movement of the landing gear or doors from that position in flight, at any speed up to V_{DF}, would not have serious consequence on the flight characteristics.

4.3.1.4 *Position indicators.* Means shall be provided, easily visible to the pilot or to the appropriate members of the flight crew, to show whether each retractable unit of the landing gear is:

(a) Locked in the correct extended position;

(b) In an intermediate position (unless the unit is visible to a member of the flight crew);

(c) Locked in the correct retracted position.

4.3.1.5 *Warning devices.* Means shall be installed to give unmistakable warning to the pilot if he makes a landing approach with the landing gear not in the locked extended position. Such means shall be in addition to, and independent of, the indicator prescribed in 4.3.1.4.

4.3.1.6 *Emergency operation.* Where other than manual operation of the landing gear is employed, satisfactory emergency means of extension shall provide for the event of any reasonably probable failure in the normal retraction system. The emergency system shall provide for the failure of any single source of hydraulic, electric, or equivalent power supply in the normal retraction system.

4.3.2 *Wheels.* Landing wheels shall have approved load ratings. The ratings shall be substantiated by tests in which loads simulating critical combinations of loads and tire pressures are applied.

Wheels selected for a particular aeroplane shall have ratings suitably related to the loads imposed on the aeroplane under the most adverse ground load conditions prescribed in 3.4.

4.3.3 *Tires.* Tires shall have approved load ratings. The ratings shall be established on the basis of simulated service tests of the particular tire type, or on the basis of detailed comparison of the tire design and construction with that of previously approved types.

The tires selected for a particular aeroplane shall have ratings suitably related to the conditions likely to occur in operating the aeroplane, taking account of:

(a) The loads sustained by the tires in taxying, including brake application;

(b) The most severe landing loads.

4.3.4 *Wheel brakes.* Brakes shall be installed and shall be such that sufficient brake force to provide satisfactory control during taxying can be applied without the use of excessive foot and hand forces.

The brake system shall have sufficient energy absorption capacity to permit adequate use to be made of the brakes during taxying.

RECOMMENDATION: The force of the brakes should be adequate to prevent the aeroplane from rolling on a paved runway when take-off power is applied to any engine.

4.3.4.1 *Brake energy absorption capacity.* If brakes are used to demonstrate compliance with the performance standards, the capacity of the brakes shall be determined by suitable tests. The capacity shall be taken as the energy which the brake can absorb without failure or serious overheating, and it shall be related conservatively to the energy actually absorbed in establishing the landing distance as prescribed in 2.3.5. Due allowance may be made for the energy absorbed by air drag.

4.3.4.2 *Brake systems.* If brakes are used to demonstrate compliance with the performance standards it shall be shown by suitable test or other data that the aeroplane can be brought to rest, under the conditions prescribed in 2.3.5, in the event of:

(a) A single failure in any connecting or transmitting element in the brake system, excluding the operating pedal or handle, and simple mechanical elements, or

(b) The loss of any single source of hydraulic or other brake operating power supply.

Under these conditions of failure, a mean negative acceleration, during the ground run, equal to at least 50% of that obtained during the determination of the landing distance, as prescribed in 2.3.5, shall be shown to be possible.

In determining this mean negative acceleration, account may be taken of the remaining effective braking forces and the aerodynamic drag, including that due to reversible pitch propellers or any other special devices which have been used in demonstrating the performance.

4.4 *Flight crew compartments.* The arrangement of the pilot compartment shall be such as to minimize the likelihood of injury to the pilot and to ensure that he will be able to perform all his duties and operate the controls in the correct manner without unreasonable difficulty, fatigue, or concentration.

An opening or an openable window shall be provided to facilitate communication between the flight crew and the passengers where the flight crew compartment is separated from the passenger cabin by a partition.

4.4.1 *Pilot's field of vision.* The arrangement of the pilot compartment shall be such as to afford a sufficiently extensive, clear, and undistorted field of vision for the safe operation of the aeroplane, and to prevent glare and reflections which would interfere with the pilot's vision.

Compliance with these standards shall be demonstrated in flight, including night flight tests for aeroplanes intended for certification as eligible for night operations in compliance with the standards of annex 6.

An openable window shall be provided for the first pilot, and this shall afford, when opened, an adequate field of vision

for the purpose of approach and landing.

4.4.1.1 *Precipitation conditions.* Provision shall be made so that, at least for the first pilot, an adequate portion of a window can be maintained in a clean condition without continuous attention from the pilot, so that it affords an adequate field of vision for normal flight, approach, and landing, under the following conditions of precipitation:

(a) Heavy rain at all speeds up to $1.6V_{s_1}$; where V_{s_1} is the stalling speed with wing flaps and landing gear retracted, at maximum sea level take-off weight;

(b) Icing conditions, if the aeroplane is to be certified as eligible to fly in icing conditions in compliance with the standards of annex 6.

4.4.2 *Window materials.* Windows, the breakage of which might otherwise injure the flight crew, shall be made of material which will not break into dangerous fragments. Windows which are essential to the pilot's field of vision shall not be made of material which may suddenly become opaque.

4.4.2.1 *Collision with birds.*

RECOMMENDATION: Consideration should be given to providing sufficient strength in the windshield, its supporting structure, and other structures in front of the pilots, to withstand the loads resulting from collision with birds.

4.5 *Exits.*

4.5.1 *Normal exits.* Aeroplanes having closed cabins shall be provided with at least one normal exit in the form of an adequate, easily accessible main door.

It shall be possible to open normal exits from both inside and outside, using one handle only in each case. The operation of the handles shall be simple, rapid and obvious, and they shall be arranged and marked so that they can be readily located and operated, even in darkness.

Reasonable provisions shall be made to prevent the jamming of doors as a result of fuselage deformation in a minor crash.

RECOMMENDATION: Main doors should open outwards to minimize jamming by occupants under panic conditions.

4.5.2 *Emergency exits.* All aeroplanes shall have suitable exits for the purpose of facilitating the rapid escape of all occupants in the event of an emergency landing. Unless an equivalent level of safety is provided (e. g., by a smaller number of larger exits), the number and size of emergency exits shall be as prescribed in 4.5.2.1 and 4.5.2.2.

4.5.2.1 *Number.*

TABLE 4-I—MINIMUM NUMBER OF EXITS PRESCRIBED

Number of seats provided for passengers and crew	*Number of exits*
5 or less	1
Exceeding 5, not exceeding 15	2
Exceeding 15, not exceeding 22	3
Exceeding 22, not exceeding 29	4
Exceeding 29, not exceeding 36	5

In the case of aeroplanes having more than 36 seats, the number and size of exits shall provide a level of safety equivalent to that prescribed by the table.

Normal exits shall not be considered as emergency exits unless they meet all the standards prescribed for emergency exits.

RECOMMENDATION: Where the adequacy of emergency exits is in doubt, a demonstration should be made to show that it is possible to evacuate the aeroplane completely in thirty seconds, or in a time equal to one second per occupant, whichever is greater, under conditions simulating an emergency landing. The number of persons participating in this demonstration should be equal to the maximum number for whom seats are provided. The persons participating may be briefed in evacuation procedure.

4.5.2.2 *Size.* Emergency exits shall consist of easily movable doors, panels, or windows, in the external walls of the cabin, providing a clear and unobstructed opening, the minimum dimensions of which will enable a 483 by 660 millimeter (19 by 26 inch) ellipse to be inscribed therein.

4.5.2.3 *Location.* The exits shall be located so as to enable them to be used to the best advantage:

(a) After a minor crash, such as may occur in an emergency landing; this shall apply to all aeroplanes;

(b) After emergency alighting on water; this shall apply to all aeroplanes complying with the standards of 3.7.3 regarding emergency alighting on water.

RECOMMENDATION: Consideration should be given to locating some of the emergency exits so that the occupants may get on the wings for embarkation into life rafts.

When the flight crew are in a separate compartment, a convenient exit shall be provided for their use.

When several exits are provided in the passenger cabin, they shall be distributed to facilitate escape from both sides of the cabin.

RECOMMENDATION: Care should be taken in locating the exits to prevent occupants who are leaving by one exit from being a hindrance to occupants leaving by another.

Where the cabin is divided into two or more compartments, each compartment shall be provided with exits, unless the passageways connecting compartments are such that they would not become blocked, or retard passenger movement, in the event of a minor crash.

The exits shall be readily accessible and shall not require exceptional agility on the part of persons using them.

4.5.2.4 *Means of opening.* The means of opening emergency exits shall be simple, rapid, and obvious. All exits shall be openable from the inside and, when more than one exit is provided, at least one exit on each side of the cabin shall be openable from the outside.

Reasonable provision shall be made against the jamming of exits as a result of fuselage deformation in a minor crash.

The proper functioning of exits shall be demonstrated by test.

4.5.2.5 *Marking.* All emergency exits, together with their means of access and means of opening, shall be marked adequately for the guidance of occupants using the exits in the light and in the dark.

4.6 *Seats, berths, safety belts.* All seats and berths and their supporting structure, and all safety belts, shall be designed for the passenger weights, and the maximum load factors and accelerations, corresponding to all relevant flight and ground load conditions, including the appropriate emergency landing conditions prescribed in 3.7.

Every seat or berth and its accompanying belt shall, as a combination, be arranged so that a person making proper use of it would be safely restrained at his station under all such load conditions.

Each belt shall have a minimum width of at least 5 centimetres (2 inches) for the portion in contact with the occupant, and shall be provided with a release mechanism which can be operated by one hand in a simple, rapid and obvious manner.

4.6.1 *Safety belt tests.* The prototype belt shall be tested to establish that its ultimate strength is adequate to withstand the most severe loads prescribed in 4.6. The belt shall then be subjected to a load almost equal to its ultimate strength, after which the load shall be reduced to approximately 114 kilograms (250 pounds) per person supported; and at this load, operation of the release mechanism shall not require abnormal physical strength.

4.7 *Cargo and baggage compartments.* Each cargo and baggage compartment shall have sufficient strength to withstand the loads resulting from the maximum weight of the contents and from the critical weight distributions at the critical load factors corresponding with all prescribed flight and ground load conditions, excluding the emergency landing conditions prescribed in 3.7.

Suitable provision shall be made to prevent hazards resulting from shifting of the contents. Such provision shall also be adequate to protect the occupants of the aeroplane from injury under the emergency landing conditions of 3.7.

The cargo and baggage compartment shall include no controls, wiring, lines, equipment, or accessories, the damage or failure of which would affect the safe operation of the aeroplane, unless such items are adequately shielded, isolated, or otherwise protected so that they cannot be damaged by movement of the contents of the compartment.

4.8 *Ventilation and heating.*

4.8.1 *Ventilation.* All passenger and crew compartments shall be suitably ventilated. Carbon monoxide concentration shall not exceed one part in 20,000 parts of air in any flight or ground condition or aeroplane configuration which is likely to be maintained for more than 5 minutes. Fuel vapour shall not be present.

4.8.2 *Heating systems.* Heating systems (including fuel burning heater installations), shall comply with the applicable parts of the power-plant installation standards pertaining to fire hazards and precautions.

4.9 *Pressure cabins.* When pressure cabins are provided, the following standards shall be complied with, in addition to the structural standards prescribed in 3.3.4.2.

4.9.1 *Pressurizing system capacity.* If cabin pressurization is used in order to permit operation at an altitude higher than the maximum altitude permitted by the standards of annex 6 without oxygen supply, the pressurizing system shall be capable of maintaining cabin

pressures at least equivalent to such maximum altitude at the highest altitude at which operation is to be permitted.

4.9.2 *Pressure control.* For the purpose of this standard the pressure differential shall be regarded as positive when the internal pressure is greater than the external.

Pressure cabins shall be provided with at least the following valves, controls and indicators:

(a) Two pressure relief valves which at the maximum rate of flow delivered by the pressure source, will limit automatically the positive pressure differential to a predetermined value not greater than that for which the structure has been designed. The capacity of each of these valves shall be such that the failure of any one valve to operate would not cause an appreciable rise in the pressure differential.

NOTE: The pressure relief valves may also be regulator valves.

(b) Two negative pressure differential relief valves (or their equivalent) which will prevent automatically a negative pressure differential high enough to damage the structure; except that one valve may be used if it is shown that the probability of its failure is extremely remote.

(c) A manually operated means available to the flight crew, by which the pressure differential can be reduced to zero rapidly.

(d) A suitable automatic or manual regulator for controlling the internal pressure and rate of exchange of air.

(e) Instruments at an appropriate flight crew station to indicate the absolute pressure in the cabin, when the maximum altitude at which operation is to be permitted exceeds the maximum altitude at which operation without oxygen supply is permitted by the standards of annex 6.

RECOMMENDATION: Suitable warning indicators should be provided, at the appropriate flight crew station, to indicate when the safe or pre-set limits on pressure differential are exceeded.

If the structure has not been designed to withstand the loads resulting from pressure differentials up to the maximum relief valve setting, in combination with landing loads, this fact shall be entered in the Aeroplane Flight Manual.

4.9.3 *Functional tests.* Functional tests shall be conducted to show that all parts of the pressurization system will function properly up to the maximum altitude at which operation is to be permitted, under all likely conditions of temperature, of moisture, and of pressure, up to the maximum relief valve setting, and during climbs and descents at rates corresponding with the maximum consistent with the operating limitations of the aeroplane.

4.10 *Compartment fire precautions.* In all passenger, cargo, and baggage compartments the materials of the cabin lining, floors, upholstery, furnishings, and tie-down equipment shall be sufficiently resistant to flame to preclude the possibility of ignition by cigarettes or matches.

RECOMMENDATION: Wherever possible, the material should be such as not to propagate combustion however ignited.

All receptacles for used towels, papers and waste shall be of fire-resistant materials and shall incorporate covers or other provisions for containing possible fires started in the receptacles.

Suitable ash containers shall be provided in all smoking compartments.

In compartments where ash containers are not provided, placards shall state that smoking is prohibited.

4.11 *Hulls and floats.*

4.11.1 *Buoyancy.*

RECOMMENDATION: For the purpose of these recommendations the term "flooded" compartment applies to a compartment inside which the water level is as high as the water line of the hull or float. The aeroplane should be considered to be at maximum take-off weight and in fresh water.

Wherever size permits, hulls and main and auxiliary floats, should be divided into compartments such that when any two compartments are flooded the aeroplane will remain afloat. In this condition the aeroplane should have a sufficient margin of positive stability to render capsizing in rough water unlikely.

The lower edge of openings in hulls and floats not provided with water-tight covers, should be located at least 0.3 meter (1.0 foot) above any water line resulting from the flooding of any two hull or main float compartments.

Bulkheads provided to separate the floats and hulls into compartments for the purpose of following the buoyancy recommendations should be water-tight, and should have sufficient strength to withstand without leakage the water loads which would arise when any one compartment is flooded. The effect of an inrush of water which might occur as a result of damage to the bottom while travelling at speed should also be considered. The top edge of such bulkheads should be at least 0.3 meter (1.0 foot) above any water line resulting from the flooding of any two compartments. If intercommunicating doors in the bulkhead are provided, such doors, when closed, should follow these recommendations.

4.11.2 *Handling gear.* Seaplanes shall be equipped with handling gear (either fixed or movable) which will permit mooring to a buoy and casting off, and towing on the water, to be performed easily and readily under all normal conditions of operation.

4.12 *Miscellaneous.*

4.12.1 *Reinforcement near propellers.* Where de-icing equipment is provided in order to comply with the Standards of Annex 6, areas near propeller tips shall have sufficient strength to withstand the impact of ice thrown from the propellers. Unless windows are designed to withstand the most severe ice impact likely to occur, they shall not be located in these areas.

4.12.2 *Window material.* Windows, the breakage of which might otherwise injure the occupants of the aeroplane, shall be made of material which will not break into dangerous fragments.

CHAPTER 5—ENGINES

5.1 *General.*

5.1.1 *Scope.* Engines shall comply with the standards of Chapter 5, except that, when an engine is of a type for which no standards have been prescribed, it shall comply with such requirements as will ensure an equivalent level of safety.

5.1.2 *Approval.* Compliance with the standards of Chapter 5 shall render an engine eligible for a certificate of type approval, certifying only the fitness of the engine for installation in an aeroplane.

NOTE: Before the aeroplane in which the engine is installed can be certificated, compliance with the standards of Chapter 7 and with all other standards in Part III has to be demonstrated)

5.1.3 *Functioning.* The engine complete with accessories shall be such as to function reliably under all conditions appropriate to the intended operation of the aeroplane in which it is to be installed.

5.2 *Reciprocating engines.* Reciprocating engines shall comply with the standards of 5.2.

5.2.1 *Design and construction.*

5.2.1.1 *Vibration.* The engine shall be designed and constructed so as to function throughout its normal operating range of crankshaft rotational speeds and engine powers without inducing excessive stress in the engine parts because of vibration, and without imparting excessive vibration forces to the aeroplane structure when the engine is properly installed, operated and maintained, in an aeroplane, and a suitable propeller is fitted.

5.2.1.2 *Ignition system.* All spark ignition engines shall be equipped either with a dual ignition system having at least two spark plugs per cylinder and two separate electrical circuits with separate sources of electrical energy, or with an ignition system which will function with equal reliability in flight.

5.2.1.3 *Engine and accessory mounting attachments.* The mounting attachments and structure of the engine shall have sufficient strength, when the engine is properly supported by a suitable engine mounting structure, to withstand the loads arising from the loading conditions prescribed in Chapter 3, and to withstand any vibration forces likely to occur.

Accessory drives and mounting attachments, shall be designed and constructed so that the engine will operate safely with the accessories attached. The design of the engine shall incorporate provisions adequate for the examination, adjustment, or removal, of all essential engine accessories.

5.2.2 *Applicant's declaration.* The applicant shall declare the conditions and limitations which are intended to govern the operation of the engine. This declaration shall include at least the following information:

(a) A brief description of the engine and its essential design features;

(b) Power ratings and all operating limitations (e. g., power, manifold pressure, crankshaft rotational speed, and altitude);

(c) Fuel or fuels to be used;

(d) Lubricating oil to be used;

(e) Coolant to be used, if any;

(f) Limitations on operating temperatures and pressures;

(g) Accessories to be fitted for the tests.

After completion of the tests the applicant shall specify the maximum permissible torque and maximum overhung moment for each accessory.

5.2.3 *Tests.*

5.2.3.1 *Scope.* Reciprocating engines of conventional design shall be subjected to the tests prescribed in 5.2.3, except that, for modified engines, the tests may be varied to suit the particular modification provided that such variation does not lower the level of safety.

For engines of unusual design, the tests prescribed in 5.2.3 shall be varied appropriately in order to achieve, as far as practicable, an equivalent level of safety.

5.2.3.2 *Conditions.* A single engine of the design and construction submitted for approval shall complete satisfactorily the vibration, calibration, detonation, endurance, and operation tests prescribed in 5.2.3, except that one or more identical engines may be used for the vibration, calibration, and detonation tests. If more than one engine is used, the engine to be used for the endurance and operation tests shall be subjected to a calibration check before starting the endurance and operation tests. The tests shall be conducted in the order described, except insofar as this paragraph admits variation of that order.

Throughout these tests, unless otherwise prescribed, all accessory drives shall be fitted either with representative accessories, or with equivalent means for simulating the loads for which the engine is designed.

Before starting and after completing the tests, a full strip examination of the endurance test engine, including measurements of wear and distortion, shall be made and recorded, except that the strip examination before the start of the tests may be omitted when the wear and distortion can be evaluated by other acceptable means.

5.2.3.3 *Vibration test.* A vibration test shall be conducted to investigate crankshaft torsional and bending vibration characteristics over the range of crankshaft rotational speed and engine power normally used in flight (including low-power operation), from idling speed to 105% of the desired take-off speed rating. The test shall be conducted with a representative propeller.

If excessive vibration is found to be present in the operating range of the engine, suitable remedial measures shall be taken prior to the endurance test.

If moderate vibration is found to exist in the operating range of the engine, either remedial measures shall be taken, or the engine used for the endurance test shall be subjected to a vibration penalty test. This penalty test shall be conducted during the endurance test and shall be substituted for appropriate portions of the test prescribed in 5.2.3.6; such penalty test shall include operation under the most adverse vibration condition for a period sufficient to establish the ability of the engine to operate without fatigue failure.

5.2.3.4 *Calibration test.* The engine shall be calibrated, after being properly run-in, to establish the power characteristics for purposes of rating the engine and of determining the endurance test conditions.

The results of this test shall constitute the basis for establishing the power and detonation characteristics of the engine over its entire operating range of crankshaft rotational speeds, manifold pressures, and fuel/air mixture settings, and for establishing its altitude performance characteristics.

All accessories not required for engine operation shall be disconnected for this test.

5.2.3.5 *Detonation test.* A test shall be conducted in which the engine is operated throughout the range of crankshaft rotational speed from the lowest intended to be used for cruising, to the rotational speed used for take-off.

In order to establish that the engine can function without detonation throughout its range of intended conditions of operation, the following shall be used in combination during this test:

(a) Full throttle, or the maximum manifold pressure to be permitted (whichever is applicable);

(b) The leanest mixture strength to be permitted;

(c) The maximum oil inlet temperature to be permitted;

(d) The maximum cylinder head or coolant outlet temperature to be permitted (whichever is applicable);

(e) The highest intake air or mixture temperature to be permitted.

NOTE: If desired, this test may be carried out in conjunction with the calibration test.

5.2.3.6 *Endurance test.* The endurance test shall consist of a total of 150 hours of operation with a representative propeller, performed in such periods and order as are considered acceptable. During the endurance test the engine power and crankshaft rotational speed shall be controlled within ±3% of the specified values of power and speed.

The test shall consist of the following:

(a) *Ninety-hour run.* Ninety hours at the maximum continuous crankshaft rotational speed and engine power at which the engine is to be rated, except that these test conditions shall be varied as prescribed in (i) if a take-off rating in excess of the maximum continuous rating is desired and, as prescribed in (ii), if a maximum continuous rating at altitude differing from the sea level maximum continuous rating is desired.

(i) If a rating in excess of the maximum continuous rating is desired for take-off purposes, this take-off rating shall be established by either conducting 10 hours of this run at the take-off speed and power, or running 20 hours with alternate 5-minute periods of operation at take-off speed and power and of operation at lower specified speeds and powers.

The engine shall not be declared safe for operation at take-off power for a period exceeding 5 minutes, except that if the take-off rating is established by means of 10 continuous hours of operation at take-off speed and power, or by two continuous 5-hour periods at such speed and power, the engine may be declared safe for emergency operation at take-off power for a period not exceeding 15 minutes.

For the establishment of aeroplane performance, operation at the take-off rating shall be limited to a period of 5 minutes.

(ii) If the maximum continuous ratings at sea level and altitude differ, half of the running at maximum continuous power shall be carried out at the maximum power obtainable at the critical altitude with the maximum continuous manifold pressure and maximum continuous crankshaft rotational speed.

NOTE: These runs may be conducted under simulated altitude conditions or at sea level using a higher grade fuel if required to suppress detonation.

At least 50 hours of the portion of this ninety-hour run, which is conducted at the maximum continuous speed and power ratings, shall be conducted with the oil inlet temperature, and cylinder head or coolant outlet temperature (whichever is applicable) equal to not less than the values declared as maxima for continuous operation.

(b) *Forty-hour run.* A total of 40 hours of operation, consisting of five periods of 8 hours each at 50, 60, 65, 70 and 75% respectively of the maximum continuous rated power.

The crankshaft rotational speed, engine manifold pressure, and mixture strength for each value of power shall be chosen so as to simulate critical cruising conditions at these powers.

(c) *Twenty-hour run.* Twenty hours at the maximum weak-mixture power for which the engine will be declared suitable for weak-mixture cruising operation, or, under the conditions prescribed in the second paragraph of (b), 20 hours at the maximum recommended cruising power.

This run shall be conducted at the maximum operating temperatures declared for these conditions.

5.2.3.7 *Operation test.* After the completion of the endurance test prescribed in 5.2.3.6 the engine shall be subjected to all tests necessary to demonstrate satisfactory backfire characteristics, starting, idling, acceleration, overspeeding, functioning of propeller and ignition, and to any other tests necessary to establish the operational characteristics of the engine.

NOTE: Certain of these characteristics may be determined during the course of the endurance test.

5.2.3.8 *Recalibration test.* At the completion of the tests prescribed in applicable portions of 5.2.3.4, 5.2.3.5, 5.2.3.6, and 5.2.3.7, the endurance test engine shall be subjected to a calibration check to determine any change in power characteristics caused by these tests. There shall be no substantial decrease in power as a result of these tests.

5.2.3.9 *Power ratings.* Power ratings shall be based upon the calibration test prescribed in 5.2.3.4, and upon the following atmospheric conditions:

(a) Dry air;

(b) Intake air temperature of 15° C. (59° F.);

(c) Atmospheric pressure of 760 millimeters (29.92 inches) of mercury.

NOTE: If engine power is affected by deviation of cooling air temperature from 15° C. (59° F.), or of coolant temperature from the declared value, appropriate corrections may be made.

5.2.4 *Engine adjustments and parts replacement during tests.* During the tests of 5.2.3, maintenance shall be confined to servicing and minor repairs except that major repairs or replacement of parts may also be made, provided that the parts in question are subjected to additional penalty tests, and provided also that the level of safety implied in 5.2.3 is not lowered. The extent of these penalty tests shall be dependent upon the nature and extent of the repairs or replacements involved.

5.2.5 *Identification.* A suitable identification plate shall be permanently attached to the engine at a location where it will be readily visible when the engine is installed in an aeroplane. This plate shall show the approved ratings of the engine.

5.2.6 *Instruction manual.* The holder of a certificate of type approval, within a reasonable time after receiving such certificate, shall prepare and submit for approval a manual or manuals containing suitable instructions for the installation, operation, servicing, maintenance, repair, and overhaul, of the certificated engine type or types.

The holder of a certificate of type approval shall make the approved instruction manual(s) available to persons engaged in the operation, maintenance, repair, or overhaul of engines manufactured under such certificate, and shall prepare, submit for approval, and make available, any revised instructions deemed necessary as a result of experience in operation.

CHAPTER 6—PROPELLERS

6.1 *General.* The term "propeller" shall, for the purpose of Chapter 6, be construed as meaning the propeller assembly, complete with accessories, unless otherwise stated.

6.1.1 *Approval.* Compliance with the standards of Chapter 6 shall render a propeller eligible for a certificate of type approval, certifying only the fitness of the propeller for installation in an aeroplane.

NOTE: Before the aeroplane in which the propeller is installed can be certificated, compliance with the standards of Chapter 7 and with all other standards in Part III has to be demonstrated.

6.1.2 *Functioning.* The propeller shall be such as to function reliably under all conditions appropriate to the intended operation of the aeroplane in which it is to be installed.

6.2 *Tests.*

6.2.1 *Scope.* Propellers of conventional design shall be subjected to the tests prescribed in 6.2, except that, for modified propellers the tests may be varied to suit the particular modification provided that such variation does not lower the level of safety. For propellers of unusual design, the tests prescribed in 6.2 shall be varied appropriately in order to achieve, as far as practicable, an equivalent level of safety.

6.2.2 *Conditions.* The prototype propeller shall complete satisfactorily the applicable tests prescribed in 6.2, without evidence of failure or malfunctioning.

Before starting and after completing the tests, a detailed inspection of the propeller parts, including measurements of wear and distortion, shall be made and recorded.

6.2.3 *Centrifugal load test for other than fixed-pitch propellers.* A centrifugal load test, conducted at rotational speeds adequate to demonstrate the ability of the propeller to resist centrifugal forces resulting from the rotation of the propeller shall be applied to:

(a) All prototype propellers (other than fixed-pitch propellers), which are not essentially identical with previously approved types;

(b) All modified propellers (other than fixed-pitch propellers), when the modifications may affect the ability of the propeller to withstand centrifugal loads;

for at least 30 minutes for adjustable pitch propellers and for at least one hour for variable pitch propellers, except that alternative tests may be made, provided that the level of safety is not lowered.

6.2.4 *Vibration test for propellers with metal blades.* A test shall be conducted on prototype propellers with metal blades to determine the magnitude of the vibration stresses which occur in the blades and blade shanks when the propeller is operated under all conditions of rotational speed and engine power for which approval is sought. The test shall be conducted on an engine similar in type or characteristics to that for which the propeller is intended.

6.2.5 *Endurance test.*

6.2.5.1 *Fixed-pitch wood propellers.* Prototype fixed-pitch wood propellers shall be subjected to at least one of the following endurance tests, unless the prototype differs from a previously approved propeller only by having a smaller pitch, a smaller diameter, or a lower power and rotational speed rating:

(a) A 10-hour endurance block test on an engine. During this test, a propeller of the greatest pitch and diameter for which approval is desired shall be operated at its proposed rated rotational speed.

(b) A 50-hour flight test: At least 5 hours of this test shall be conducted with the propeller operating at the proposed rated rotational speed; during the remaining 45 hours the propeller shall be operated at not less than 90% of the proposed rated rotational speed; these tests shall be conducted in level flight or in climb.

(c) A 50-hour endurance block test on an engine at the power and propeller rotational speed for which approval is desired: A specially constructed propeller of the design for which approval is desired, but with a pitch which will permit its operation at the desired power and speed, may be used for this test.

6.2.5.2 *Fixed-pitch metal propellers and adjustable pitch propellers.* Prototype fixed-pitch propellers with metal blades and prototype adjustable pitch propellers shall be subjected to one of the tests specified in 6.2.5.1 (b), 6.2.5.1 (c), 6.2.5.3 (a) or 6.2.5.3 (b).

6.2.5.3 *Variable pitch propellers.* Prototype variable pitch propellers shall be subjected to one of the following:

(a) An endurance block test consisting of—

(i) At least 100 hours duration on an engine of the same power and speed characteristics as the engine or engines with which the propeller is intended to be used.

At least 50 hours of this test shall be conducted at the proposed maximum continuous rotational speed and power rating of the propeller. The remaining portion of the test shall be run at the rotational speed and power conditions deemed appropriate, taking into consideration the findings of the vibration test;

(ii) An additional 10-hour test conducted at the maximum power and rotational speed proposed for the take-off rating, if a rating in excess of the maximum continuous rating is desired for take-off purposes;

(b) Operation on an engine throughout the type test of 5.2.3.6, if the ratings desired for the propeller are the same as the ratings desired for the engine undergoing the test.

6.2.6 *Functional tests for variable pitch propellers.* The propeller used in the endurance test of 6.2.5.3 shall be subjected to the following functional tests conducted while the propeller is driven by an engine mounted on a test stand or in an aeroplane.

NOTE: If desired, these tests may be conducted during the endurance test of 6.2.5.3.

(a) *Manually controllable propellers.* Five hundred complete cycles of control throughout the pitch and rotational speed range for which operation is intended.

(b) *Automatically controllable propellers.* Fifteen hundred complete cycles of control by means of the automatic control mechanism throughout the pitch and rotational speed range for which operation is intended.

(c) *Feathering propellers.* Fifty cycles of feathering operation.

(d) *Reversible pitch propellers.* Two hundred complete cycles of control from the lowest normal pitch to maximum reverse pitch. At the end of each cycle the propeller shall be operated in reverse pitch for a period of one minute at the maximum rotational speed and power for which approval for operation in reverse pitch is desired.

(e) *All variable pitch propellers.* A determination of the overspeeding characteristics of the propeller followed by one period of 10 minutes duration run at a propeller rotational speed 5% in excess of the maximum speed attained during these determinations.

6.2.7 *Miscellaneous tests.* Water spray, low temperature, or other tests, shall be conducted when such tests are considered necessary because of unconventional features of design, material, construction, or other reasons.

6.3 *Propeller adjustments and parts replacement during tests.* At the completion of all the prescribed tests, the propeller shall be in a condition for continued safe operation without replacement of any parts.

During the tests of 6.2, maintenance shall be confined to servicing and minor repairs, except that major repairs or replacement of parts may also be made,

provided that the parts in question are subjected to additional penalty tests, and provided also that the level of safety implied in 6.2 is not lowered. The extent of these penalty tests shall be dependent upon the nature and extent of the repairs or replacements involved.

6.4 *Identification.* Suitable identification data shall be permanently marked on, or attached to, a non-critical surface of each propeller or its hub. Such data shall be visible when the propeller is installed in an aeroplane.

6.5 *Instruction manual.* The holder of a certificate of type approval, within a reasonable time after receiving such certificate, shall prepare and submit for approval a manual or manuals containing suitable instructions for the installation, operation, servicing, maintenance, repair and overhaul, of the certificated propeller type or types. Such instructions also shall list and cover all accessories approved with the propeller.

The holder of a certificate of type approval shall make the approved instruction manual(s) available to persons engaged in the operation, maintenance, repair, or overhaul, of propellers manufactured under such certificate, and shall prepare, submit for approval, and make available, any revised instructions deemed necessary as a result of experience in operation.

CHAPTER 7—POWERPLANT INSTALLATION

7.1 *General.* All components of the powerplant installation shall be constructed, arranged, and installed so as to ensure their safe operation during the normal periods between inspections and overhauls. Accessibility shall be provided to permit such inspection and maintenance necessary for the continued airworthiness of the aeroplane.

7.2 *Installations with reciprocating engines.*

7.2.1 *Isolation.* The powerplants shall be isolated each from the other so that the failure of malfunctioning of any engine, or of any part of the powerplant installation serving any engine, will neither prevent the safe immediate operation of the remaining engine or engines, nor require immediate action by the pilot for their continued operation.

7.2.2 *Engines.* Engines shall be of a type approved in accordance with the standards of Chapter 5.

7.2.2.1 *Control of engine rotation.* Means shall be provided for stopping and restarting in flight any individual engine. All those components provided for this purpose, which are located on the engine side of the firewall and which might be exposed to fire, shall be of fire-resistant construction.

7.2.3 *Propellers.* Propellers shall be of a type approved in accordance with the standards of Chapter 6.

7.2.3.1 *Propeller installation tests.*

7.2.3.1.1 *Propeller vibration.* The magnitude of the vibration stresses in metal propeller blades, under all normal conditions of operation, shall be determined by actual measurement, or by comparison with similar installations for which such measurements have been made. The vibration stresses thus determined shall not exceed values which have been demonstrated to be safe for continuous operation.

7.2.3.2 *Propeller pitch and speed limitations.*

7.2.3.2.1 Fixed-pitch propellers, adjustable pitch propellers, and variable pitch propellers which cannot be controlled in flight, shall comply with (a) and (b).

(a) During ground run-up, take-off and initial climb at best rate of climb speed, the propeller shall limit the engine crankshaft rotational speed to a value not exceeding the maximum permissible take-off rotational speed.

(b) During a closed throttle glide at speeds up to V_{NE}, the propeller shall not permit the engine to rotate at an excessive overspeed.

7.2.3.2.2 Variable pitch propellers without constant speed controls, shall have stops or other means incorporated in the propeller mechanism to restrict the pitch range and limit:

(a) The lowest possible blade pitch to a value which will ensure compliance with 7.2.3.2.1 (a);

(b) The highest possible blade pitch to a value not lower than the pitch with which compliance with 7.2.3.2.1 (b) can be demonstrated.

7.2.3.2.3 Variable pitch propellers with constant speed controls, shall be provided at the governor with means for limiting the propeller rotational speed. Such means shall be set to limit the maximum possible governed engine rotational speed to a value not exceeding the maximum permissible.

7.2.3.3 *Propeller clearance.* Adequate clearance between the propeller and the ground, the water, and adjacent portions of the aeroplane structure shall be provided so as to minimize the possibility of adverse effects on the propeller or aeroplane structure and of damage either from ground particles or water spray.

7.2.3.4 *Propeller anti-icing and de-icing provisions.* When the aeroplane is provided with anti-icing facilities in order to comply with the standards of annex 6 such facilities shall include means both for the prevention and for the removal of ice accumulations on the propellers and on any associated accessories, such as cooling fans, on which ice is likely to form.

NOTE: If inflammable fluid is used, see the fire protection standards of 7.2.9.

7.2.4 *Fuel systems.* Fuel systems shall be constructed and arranged so as to ensure a supply of fuel to each engine at a flow rate and pressure which have been established for satisfactory engine functioning under all normal conditions of operation within approved limits, including all maneuvers for which the aeroplane is intended.

7.2.4.1 *Fuel flow rate tests.* Tests shall be conducted to demonstrate that the fuel flow rate is not less than that prescribed in 7.2.4.1.1 or 7.2.4.1.2, whichever is applicable. These tests shall be made with a low fuel supply and to a schedule sufficiently comprehensive to cover all engine operating conditions within approved limits, all attitudes possible in sustained flight, and all the various combinations under which the fuel system can be operated.

7.2.4.1.1 *Gravity feed systems.* The fuel flow rate for gravity feed systems shall be at least 150% of the fuel consumption of the engine at maximum take-off power.

7.2.4.1.2 *Pump systems.* The fuel flow rate for pump systems shall be at least 125% of the fuel consumption of the engine at maximum take-off power.

This flow rate shall be obtainable from the primary engine driven pump acting alone and from the emergency pumps with the primary engine driven pump inoperative, in both cases, at the pump speeds obtainable during take-off operation.

In the case of hand operated emergency pumps, the test speed shall be not more than 60 complete cycles (120 single strokes) per minute.

7.2.4.2 *Vapor lock test.* Fuel systems shall be arranged so as to minimize the possibility of the formation of vapor locks under all normal conditions of operation.

There shall be no evidence of vapor locks, or other malfunctioning, when the aeroplane is operated with the approved fuel at a temperature of not less than 43.5° C. (110° F.), and is climbed, at the maximum rate of climb likely to be achieved in operation, to the altitude at which the one engine inoperative best rate of climb is not more than the approved minimum prescribed in 2.3.4.2.2, for the weight corresponding with operation with full fuel tanks, minimum crew, and only that ballast necessary to maintain the centre of gravity within the limits for which the aeroplane is to be certificated.

Compliance with this standard shall be demonstrated either in flight or by means of a ground installation which closely simulates flight conditions.

NOTE: The tests may be made with a fuel of a nature and at a temperature which will produce equivalent conditions, especially as regards volatility.

7.2.4.3 *Fuel feed tests.*

7.2.4.3.1 *Fuel feed tests with low fuel.* The quantity of fuel available for use in each tank shall be determined by ascertaining the amount of unusable fuel (i. e., the amount of fuel remaining when, under the most adverse conditions, the first evidence of malfunctioning of the engine occurs), and reducing by that amount the known capacity of the tank.

The investigation shall cover the most adverse conditions and shall include the conditions prescribed herein except that, where more than one tank is installed, any tank which is not necessary to supply the engine in all the conditions prescribed need be investigated only for those flight conditions in which it will be used, and the unusable fuel for the tank in question shall then be based on the most critical of those conditions.

The prescribed conditions are:

(a) Level flight at maximum continuous power, or at the power necessary for level flight at V_{NO}, whichever is the lesser;

(b) Climb at maximum landing weight and take-off safety speed (see 2.3.3.2) with wing flaps in the take-off position, landing gear retracted and engines operating at maximum take-off power;

(c) Sideslips and skids in level flight, climb, and glide, of a severity likely to be encountered in turbulent air in normal conditions of operation.

Where the fuel available for use in a tank is determined only from the most critical flight conditions in which that tank will be used, the appropriate members of the flight crew shall be informed either by placard, or by instructions in the Aeroplane Flight Manual, of the conditions under which the full amount of usable fuel is available.

7.2.4.3.2 *Reserve tanks.* For reserve tanks not normally connected to the engine feed system the quantity of fuel available for use shall be determined as that quantity transferable under the conditions of 7.2.4.3.1.

7.2.4.3.3 *Feed change.* If an engine can be supplied with fuel from more than one tank, and engine malfunctioning becomes apparent due to the depletion of the fuel supply in any tank from which the engine can be fed, it shall be possible to regain full power and the prescribed fuel pressure in that engine within 20 seconds after switching to another supply. Compliance with this standard shall be demonstrated in flight.

7.2.4.3.4 *Tests for flow between interconnected tanks.* In the case of systems with tanks the outlets of which are interconnected, it shall not be possible for fuel to flow between tanks in quantities sufficient to cause an overflow of fuel from the tank vent, when the tanks are full, and the aeroplane is operated as prescribed in 7.2.4.3.1.

7.2.4.4 *Fuel system arrangement.*

7.2.4.4.1 *Fuel system independence.* Fuel systems shall be arranged so that the failure of any one of their components will not result in the permanent loss of power of more than one engine.

It shall not be possible for any one pump to draw fuel from more than one tank at a time, unless means are provided to prevent the introduction of air into the system.

The fuel system shall be arranged so that under critical operating conditions it will permit compliance with 7.2.1.

7.2.4.4.2 *Pressure cross feed arrangement.* Pressure cross feed lines shall not pass through compartments of the aeroplane which carry personnel or cargo, unless at least one of the following is complied with:

(a) They shall be provided with means to permit the appropriate members of the flight crew to shut off the supply of fuel to these lines;

(b) They shall be in a fuel and vapor proof enclosure ventilated and drained to the exterior of the aeroplane;

(c) They shall consist of lines so routed or protected as to avoid accidental damage and not having fittings on or within the personnel or cargo compartments.

Lines which can be isolated from the remaining of the fuel system by means of valves at each end shall incorporate provisions for the relief of excessive pressures due to high ambient temperatures.

7.2.4.5 *Fuel tank installations.* Fuel tank supporting structures shall have sufficient strength to withstand without failure any vibration, inertia and structural loads to which they may be subjected in normal conditions of operation.

Flexible tank liners shall be supported so that they are not subjected to loads resulting from the weight of the fuel.

Spaces adjacent to the surfaces of the tank shall be ventilated adequately, to avoid vapor accumulation if minor leakage occurs. Isolated compartments in which tanks are installed shall be ventilated and drained.

Provision shall be made to minimize pressure differentials between the exteriors and the interiors of tanks, except in the case of pressurized tanks.

Fuel tanks shall not be located on the engine side of the firewall and adequate clearance shall be provided between the tank and the firewall to minimize the hazard resulting from fire in the engine compartment.

No portion of the engine nacelle skin which lies immediately behind a major air exit from the engine compartment shall act as the wall of an integral tank.

Fuel tanks located in personnel compartments shall be isolated therefrom by being placed in leakproof enclosures ventilated and drained to the outside of the aeroplane.

Provision shall be made to prevent (under all conditions, including refuelling) the entry of fuel into the fuel tank compartment or into any portion of the aeroplane other than the tank itself.

The word "fuel", the permissible fuel octane rating for the engine installed, and the usable fuel capacity, shall be marked on, or adjacent to, the filler cap.

NOTE: This standard is not intended to preclude the use of words equivalent for "fuel" in other languages.

7.2.4.6 *Fuel tank construction.* Fuel tanks shall have sufficient strength to withstand without failure any vibration, inertia, fluid and structural loads, to which they may be subjected in normal conditions of operation.

Integral type fuel tanks shall be provided with access openings suitable for the inspection and repair of the tank interior.

Flexible tank liners shall be of a type approved for the particular installation.

Fuel tanks shall be provided with a suitable expansion space. It shall not be possible to fill this space inadvertently when the aeroplane is in the normal ground attitude.

Fuel tank outlets shall be provided with a suitable coarse mesh screen. The screen shall be accessible for inspection and cleaning.

Fuel tanks shall be provided with drainable sumps of adequate capacity or, if the safe functioning of the system is not thereby impaired, the system shall have sediment bowls of adequate capacity located at points where it is possible to drain the entire tank capacity and portion of the system leading to this point.

7.2.4.7 *Fuel tank strength.* Fuel tanks shall have sufficient strength to withstand without failure or leakage, the appropriate following tests:

(a) *Pressure tests for non-pressurized tanks.* For tanks which do not form a part of the aeroplane structure: a pressure of 0.21 kilogram per square centimeter (3.0 pounds per square inch), or the pressure developed with the tank full during the maximum acceleration of the aeroplane corresponding with the ultimate loads, whichever is greater.

RECOMMENDATION: Tanks which form a part of the aeroplane structure or which consist of a portion of the aeroplane structure supporting a flexible liner should have sufficient strength to withstand without failure or leakage the application of the critical combination of internal pressure developed during the maximum acceleration of the aeroplane with full tanks and the corresponding ultimate structural loads.

(b) *Pressure tests for pressurized tanks.* The pressure applicable to non-pressurized tanks, increased by the design working pressure.

(c) *Additional tests.* (i) For tanks incorporating large unsupported or unstiffened flat areas: a suitable combined vibration and oscillation test with the tank approximately three-quarters full.

(ii) For tanks with non-metal liners: a suitable oscillation test with the tank approximately three-quarters full of fuel at appropriate temperatures.

7.2.4.8 *Fuel quantity indicators.* (See 7.2.7.1.1.)

7.2.4.9 *Fuel flowmeters.* (See 7.2.7.1.2.)

7.2.4.10 *Fuel system lines, fittings, valves and accessories.* (See also 7.2.9.10 and 7.2.9.11.)

7.2.4.10.1 *Fuel lines.* Lines shall be installed and supported so as to prevent excessive vibration and to withstand loads due to accelerated flight conditions and fluid pressure, and to minimize the possibility of damage due to rough landing. Lines connected to components of the aeroplane between which relative motion may occur shall incorporate provisions for flexibility. Flexible lines shall be of a type approved for the particular installation.

7.2.4.10.2 *Fuel strainers.* A fuel strainer shall be installed between the fuel tank outlet and the carburetor inlet. If an engine driven fuel pump is provided, the strainer shall be located between the tank outlet and the pump inlet, and shall be accessible readily for draining and cleaning.

7.2.4.10.3 *Fuel valves.* Means shall be provided by which the appropriate members of the flight crew can shut off rapidly during flight, the flow of fuel to any individual engine. Valves provided for this purpose shall be installed in a protected location and shall be as close as practicable to the side of the firewall remote from the engine. It shall be demonstrated that no appreciable amount of fuel will drain into the engine compartment after the valve has been closed.

Valves shall be provided with positive stops at, or indexing provisions in, the "on" and "off" positions; they shall be supported so that loads resulting from their operation or from accelerated flight conditions, are not transmitted to the lines connected to them.

Shut-off valves shall be constructed so that the appropriate members of the flight crew can re-open the valves after they have been closed.

7.2.4.10.4 *Fuel drains.* It shall be possible to drain the entire system without hazard of fire. All drains shall discharge clear of all parts of the aeroplane, and

shall be provided with means for positive, or automatic, locking in the closed position. All drains shall be accessible readily.

7.2.4.10.5 *Fuel tank vents.* The fuel tank expansion space shall be vented adequately under all conditions of operation. Vents shall be constructed so as to preclude the possibility of fuel syphoning during normal conditions of operation, and shall be of sufficient size to permit the rapid relief of excessive pressure differentials between the exteriors and the interiors of tanks.

Vent outlets shall be located and constructed so as to preclude the possibility of their becoming obstructed by ice or by other foreign matter.

Drainage shall be provided to preclude the accumulation of moisture in vent lines, when the aeroplane is in the ground attitude and when it is in the level flight attitude.

Air spaces of tanks shall be interconnected if the tank outlets are interconnected.

7.2.4.10.6 *Carburetor vapor vents.* Carburetors having a vapor vent connection shall be provided with a vent line leading the vapor back to one of the fuel tanks. If it is necessary to use tanks in a definite sequence, the vapor vent return line shall lead back to the fuel tank first used, unless the relative capacities of the tanks are such that return to another tank is preferable.

7.2.4.10.7 *Fuel pumps.* If fuel pumps are provided, at least one pump for each engine shall be driven by the engine. The fuel pressure at the inlet to the carburetor shall be maintained within the range of limits established for satisfactory engine operation.

Positive displacement fuel pumps shall be provided with an integral by-pass, unless equivalent provisions are made to permit the system to continue to supply fuel to all engines in the case of failure of the pumps. This shall not apply to fuel injection pumps approved as an integral part of the engine.

Immediately available emergency fuel pumps shall be provided, and their capacity shall be adequate to permit continuance of the prescribed flow rate to all engines in case of the failure of any one fuel pump. Hand operated emergency pumps shall not require excessive effort for their continued operation.

NOTE: See 7.2.4.1.2 for pump systems flow rates.

7.2.4.11 *Fuel jettisoning systems.* The quantity of fuel to be jettisoned, if any, shall be established with relation to the difference between the maximum weights allowed for take-off and for landing. It shall be possible to jettison any such quantity of fuel at a rate of at least 1% of the maximum take-off weight per minute when the aeroplane is flown under the conditions specified below, except that the total time necessary for jettisoning such quantity need not be less than 10 minutes.

The fuel jettisoning system shall safely discharge the fuel clear of all parts of the aeroplane under all of the following conditions of flight, at the maximum take-off weight, and with wing flaps and landing gear retracted:

(a) Power-off glide at a speed of $1.4V_{s_1}$;

(b) Climb with the critical engine inoperative and the remaining engines at maximum continuous power at a speed not in excess of that at which compliance with the cooling standards of 7.2.6.1 has been demonstrated during flight and at which the aeroplane meets the performance standard of 2.3.4.2.2.

(c) Level flight at a speed of $1.4V_{s_1}$, unless the tests prescribed in (a) and (b) above show this test to be unnecessary.

Unless it is demonstrated that wing flap position does not affect fuel jettisoning adversely, a placard shall be provided, adjacent to the jettisoning control, to warn appropriate members of the flight crew against jettisoning fuel while the wing flaps are lowered. Information to this effect shall be included also in the Aeroplane Flight Manual.

The jettisoning operation shall not affect the control of the aeroplane adversely.

In tanks which are used in take-off and landing, it shall not be possible to reduce the quantity of fuel below the level providing 45 minutes of operation at 75% maximum continuous power, unless the jettisoning of the fuel below this level is accomplished by the operation of a separate auxiliary control after the normal jettisoning operation has been completed.

It shall be possible to close the jettisoning valve during any period of the jettisoning operation.

Compliance with these Standards shall be demonstrated in flight.

7.2.5 *Oil systems.* Each engine shall be provided with an independent system capable of supplying the engine with an ample quantity of oil at a temperature not exceeding the maximum established for safe continuous operation.

The capacity of the oil system shall be not less than the product of the endurance of the aeroplane in normal conditions of operation and the maximum permissible oil consumption of the engine as stated in the Engine Instruction Manual, plus a suitable safety margin.

7.2.5.1 *Oil system cooling tests.* The ability of the oil cooling system to maintain the engine oil inlet temperature within the maximum and minimum established values, at any appropriate condition of flight, shall be demonstrated in accordance with 7.2.6.

7.2.5.2 *Oil tank installations.* Oil tanks shall be installed so as to ensure safe functioning under all conditions of operation.

The word "Oil", and the tank capacity, shall be marked on, or adjacent to, the filler cap.

NOTE: This standard is not intended to preclude the use of words equivalent for "oil" in other languages.

7.2.5.3 *Oil tank construction.* Oil tanks shall have sufficient strength to withstand without failure all vibration, inertia, and fluid loads, to which they may be subjected under all normal conditions of operation, together with any superimposed load which it is necessary to take into account for the particular installation.

Flexible tank liners shall be of a type approved for the particular installation.

Oil tanks shall be provided with an adequate expansion space to allow for foaming, expansion of the oil, and the oil displaced during operation.

The oil tank outlet shall be protected with a coarse mesh screen, or other guard, which will not reduce the oil flow below that necessary at any operating temperature condition.

If the propeller feathering system makes use of the engine oil supply, provision shall be made to trap a quantity of oil in the tank, in case the supply becomes depleted due to failure of any portion of the lubricating system other than the tank itself. The quantity of oil so trapped shall be sufficient to accomplish the feathering operation, and shall be available only to the feathering pump.

The ability of the system to complete the feathering operation in the above case shall be demonstrated on the ground or in flight.

Adequate provision shall be made to prevent the ingress of sludge, or other foreign matter, into the feathering pump system.

7.2.5.4 *Oil tank strength.* Oil tanks shall be capable of withstanding the following tests without failure or leakage:

(a) A pressure test of 0.35 kilogram per square centimeter (5 lbs. per square inch), or a pressure corresponding to that developed with the tank full during the maximum acceleration of the aeroplane corresponding with the ultimate loads, whichever is greater;

(b) A specified oscillation test with the tank approximately three-quarters full of oil at the maximum anticipated operating temperature when non-metal liners are to be used in oil tanks. The test shall be conducted with liner installed.

7.2.5.5 *Oil quantity indicators.* (See 7.2.7.1.3.)

7.2.5.6 *Oil temperature indicators.* (See 7.2.7.1.4.)

7.2.5.7 *Oil system lines, fittings, valves and accessories.* (See also 7.2.9.10 and 7.2.9.11.)

7.2.5.7.1 *Oil lines.* Oil lines shall comply with 7.2.4.10.1.

7.2.5.7.2 *Oil valves.* Except in the case of installations utilizing wet sump engines, a valve shall be provided by which the flow of oil to each individual engine can be shut off during flight. If the oil tank is located outside the engine compartment, the valve shall be located on the same side of the firewall as the tank, and as close to the firewall as possible. If the tank is located on the engine side of the firewall, the valve shall be mounted on the tank, or shall be connected to the tank by means of a fireproof line.

The controls for shut-off valves located on the engine side of the firewall shall be of fire-resistant construction.

Valves shall be provided with positive stops at, or indexing provisions in, the "on" and "off" positions; they shall be supported so that loads resulting from their operation, or from accelerated flight conditions, are not transmitted to the lines connected to them.

Shut-off valves shall be constructed so that it is possible for the appropriate members of the flight crew to re-open the valves after they have been closed.

The oil shut-off control shall be so arranged and installed, or it shall incorporate such provisions, as to minimize the possibility of starting the engine with the shut-off valve closed.

7.2.5.7.3. *Oil drains.* Oil drains shall comply with 7.2.4.10.4.

7.2.5.7.4 *Oil breather lines.* Engine oil breather lines shall be arranged so that condensed water vapor cannot accumulate and freeze, or cannot obstruct the line at any point.

Engine oil breather lines shall be located so that discharge will not constitute a fire hazard. Oil discharged from the lines shall not enter the engine air-intake system, nor shall it impinge upon any portion of the aeroplane on which it will have detrimental effects.

7.2.5.7.5. *Oil tank vents.* Oil tank expansion spaces shall be vented adequately under all normal conditions of operation. Oil tank vent lines shall comply with the standards of 7.2.5.7.4 for oil breather lines.

7.2.5.7.6 *Oil radiators.* Oil radiators shall have sufficient strength to withstand without failure any temperature changes, and any inertia and oil pressure loads, to which they may be subjected in normal operation.

Oil radiator air ducts shall be located so that in the event of fire, flames issuing from normal openings of the engine nacelle will not impinge directly upon the radiator.

7.2.5.7.7 *Oil filters.* Oil filters shall be constructed and installed so that complete blocking of the flow through the filter element will not prevent the safe operation of the engine.

7.2.6 *Cooling.* The powerplant cooling system shall be capable of maintaining the temperatures of all major powerplant components, engine fluids, mixture, or carburetor intake air, within the established safe values, under all conditions of ground, water and flight operation, at air temperatures up to the maximum anticipated air temperatures of 7.2.6.1 appropriate to the intended operation of the aeroplane.

7.2.6.1 *Maximum anticipated air temperatures.* Except as provided in 7.2.6.1 (a) and (b), the maximum anticipated sea level air temperature shall be assumed to be 37.7° C. (100° F.). This temperature shall be assumed to decrease at the rate of 6.56° C. per kilometre (3.6° F. per 1,000 feet) of altitude above sea level, until a minimum permissible temperature of —55° C. (—67° F.) is reached.

(a) In the case of aeroplanes the operation of which will be confined to localities where maximum temperatures are always of moderate intensity, it may be assumed that the maximum anticipated sea level air temperature is 29.3° C. (85° F.), and that it decreases at the rate of 6.56° C. per kilometre (3.6° F. per 1,000 feet), of altitude above sea level until a minimum permissible temperature of —40° C. (—40° F.) is reached. If these maximum anticipated air temperatures are used, it shall be so stated in the Aeroplane Flight Manual, and the aeroplane shall be limited in operation accordingly.

(b) For aeroplanes intended for extreme tropical operation, higher maximum anticipated air temperatures shall be used. The highest outside air temperatures which are used shall be stated in the Aeroplane Flight Manual.

7.2.6.2 *Cooling system tests.* Compliance with the standards of 7.2.6 shall be demonstrated under critical ground, water, and flight operating conditions.

The fuel used during the cooling tests shall be of the minimum octane rating approved for the engine and the operating conditions involved, and the mixture settings shall be those normally employed in these operating conditions.

If the tests are conducted under atmospheric temperatures deviating from the maximum anticipated air temperatures of 7.2.6.1, the recorded powerplant temperatures shall be corrected as prescribed in 7.2.6.2.1. The corrected temperatures determined in this manner shall remain within the established safe values.

7.2.6.2.1 *Cylinder head and barrel, coolant, oil inlet, mixture or carburetor air inlet temperature corrections.* The cylinder head and barrel, the coolant, the oil inlet and the mixture or carburetor air inlet temperatures shall be corrected for the difference between the maximum anticipated air temperature and the temperature of the ambient air at the time of recording during the cooling test. The correction shall be equal to the actual difference in temperatures, unless some other correction can be justified.

7.2.6.3 *Liquid cooling systems.* Each liquid cooled engine shall be provided with an independent cooling system. The cooling system shall be arranged so that no air or vapor can be trapped in any portion of the system, other than the expansion tank, either during filling or during operation.

The ability of the cooling system to maintain the outlet temperature within the established values shall be demonstrated as prescribed in 7.2.6.2.

Means shall be provided to prevent excessive pressures in the cooling system.

7.2.6.3.1 *Coolant expansion tanks; installation.* Coolant expansion tanks shall be installed so as to ensure safe functioning under all conditions of operation.

The type of the coolant used and the capacity of the system shall be marked on, or adjacent to, the filler cap.

7.2.6.3.2 *Coolant expansion tanks; construction.* Coolant expansion tanks shall have a usable capacity of not less than 3.8 liters (one U. S. gallon), and shall have sufficient strength to withstand without failure all vibration, inertia, and fluid loads, to which they may be subjected in normal operation.

Coolant tanks shall be provided with an expansion space of not less than 10% of the cooling system capacity and it shall not be possible to fill this expansion space inadvertently when the aeroplane is in the normal ground attitude.

7.2.6.3.3 *Coolant expansion tanks; strength.* Coolant expansion tanks shall withstand the following tests without failure or leakage.

(a) *Pressure tests for non-pressurized tanks.* The pressure test prescribed in 7.2.4.7 (a).

(b) *Pressure tests for pressurized tanks.* Either a test pressure equal to the sum of the working pressure of the cooling system and the pressure developed with the tank full during the maximum acceleration of the aeroplane corresponding with the ultimate loads, or a test pressure of 1.25 times the maximum working pressure of the system, whichever is greater.

(c) *Additional tests.* A specified oscillation test with the tank approximately three-quarters full of coolant at appropriate temperatures when non-metal liners are to be used in coolant expansion tanks. The test shall be conducted with liner installed.

7.2.6.3.4 *Coolant temperature indicators.* (See 7.2.7.1.5.)

7.2.6.3.5 *Cooling system lines and fittings.* Cooling system lines and fittings shall be installed and supported so as to prevent excessive vibration loads and to withstand loads due to accelerated flight conditions and operating pressures of the cooling system. Lines connecting components of the aeroplane between which relative motion may occur shall incorporate provisions for flexibility. Flexible lines shall be of a type approved for the particular installation.

Fire-resistant coolant lines shall be provided where and as prescribed in 7.2.9.10 and 7.2.9.11.

7.2.6.3.6 *Cooling system drains.* One or more drains shall be provided to permit drainage of the entire cooling system, including the tank, radiator, and engine, when the aeroplane is in the normal ground attitude.

Cooling system drains shall comply with 7.2.4.10.4.

NOTE: See also 7.2.9.10.

7.2.6.3.7 *Coolant radiators.* Coolant radiators shall have sufficient strength to withstand without failure any temperature changes and any vibration, inertia, and coolant pressure loads, to which they may be subjected in normal operation.

Radiators shall be supported so as to permit expansion due to operating temperatures and to prevent harmful vibration being transmitted to them.

If the coolant employed is inflammable, the air intake duct to the coolant radiator shall be located so that in the event of fire, flames issuing from normal openings of the engine nacelle do not impinge directly upon the radiator.

7.2.7 *Powerplant instruments, controls, and accessories.*

7.2.7.1 *Instruments.* (See 8.1 and 8.2 for minimum equipment required.)

The standards of 7.2.4.10.1 shall apply to powerplant instrument lines. In addition, instrument lines carrying inflammable fluids or gases under pressure shall be provided with restricted orifices (or equivalent safety devices), at the source of the pressure, to prevent escape of excessive amount of fluid or gas in case of line failure.

NOTE: (See also 7.2.9.10 for fire-resistant instrument lines.)

7.2.7.1.1 *Fuel quantity indicators.* Means shall be provided to indicate to the appropriate members of the flight crew, during flight, the quantity of usable fuel in each tank.

NOTE: (Tanks of which the outlets and air spaces respectively are interconnected may be considered as one tank, and need not be provided with separate indicators.)

Indicators shall be calibrated to read zero during cruising level flight, when the quantity of fuel remaining in the tank is equal to the unusable fuel supply as defined in 7.2.4.3.1.

Sight gauges shall be installed or guarded so as to minimize the likelihood of breakage or damage.

7.2.7.1.2 *Fuel/air ratio indicators and fuel flowmeters.* Unless automatic mixture controls are installed, means shall be provided to enable the appropriate members of the flight crew to determine, during flight, either the fuel/air ratio or the rate of fuel flow for each engine.

If malfunctioning of the metering component of a flowmeter can result in severe restriction of the fuel flow, a suitable by-pass shall be incorporated in the metering component.

7.2.7.1.3 *Oil quantity indicators.* Means shall be provided to enable the quantity of oil in each tank to be measured when the aeroplane is on the ground. If an oil transfer system or a reserve oil supply system is installed, means shall be provided to indicate to the appropriate members of the flight crew, during flight, the quantity of oil in each tank.

Sight gauges shall be installed or guarded so as to minimize the likelihood of breakage or damage.

Indicators shall be marked in suitable increments so that they will indicate the quantity of oil readily and accurately, throughout their range.

7.2.7.1.4 *Oil temperature indicators.* Means shall be provided to indicate to the appropriate members of the flight crew, during flight, the oil inlet temperature of each engine.

7.2.7.1.5 *Coolant temperature indicators.* Means shall be provided to indicate to the appropriate members of the flight crew, during flight, the coolant outlet temperature of each liquid cooled engine.

7.2.7.1.6 *Cylinder head temperature indicators.* A cylinder head temperature indicator shall be provided for each air-cooled engine, to indicate the temperature of the known hottest cylinder in the installation.

7.2.7.1.7 *Engine intake air temperature indicators.* A carburettor intake air temperature indicator shall be provided for each altitude rated engine equipped with a preheater capable of providing a temperature rise in excess of 33.3° C. (60° F.).

7.2.7.2 *Controls.* All powerplant controls shall be located so that they are within easy reach of the appropriate members of the flight crew, and so that they cannot be operated inadvertently by personnel entering or leaving the aeroplane, or by the flight crew while they are performing their duties.

Controls shall maintain the position in which they are set.

Controls shall have adequate strength and rigidity to withstand operating loads without failure or excessive deflection.

Flexible controls shall be of an approved type.

NOTE: See 7.2.9.11.1 for fire-resistant controls and 9.4.2 for control markings.

7.2.7.2.1 *Throttle controls.* Separate throttle controls shall be provided for each engine. They shall be grouped and arranged so as to permit separate control of each engine and simultaneous control of all engines.

Throttle controls shall operate so that a forward movement is necessary to increase power. They shall afford a positive and immediately responsive means of controlling the engines.

7.2.7.2.2 *Ignition switches.* Ignition switches shall be provided for each ignition circuit on each engine.

Ignition circuits shall be independent of any other electrical circuit.

Means shall be provided for shutting off all ignition quickly either by the grouping of switches, or by a master ignition control. If a master control is provided, a suitable guard shall be incorporated to prevent inadvertent operation.

7.2.7.2.3 *Mixture controls.* If mixture controls are provided, there shall be a separate control for each engine. The controls shall be grouped and arranged so as to permit separate control of each engine and simultaneous control of all engines.

7.2.7.2.4 *Propeller speed and pitch controls.* If propeller speed and pitch controls are provided, there shall be a separate control for each propeller. The controls shall be grouped and arranged so as to permit separate control of each propeller and simultaneous control of all propellers.

In flight a forward movement of the control shall increase the rotational speed.

Synchronization of all propellers shall be possible.

7.2.7.2.5 *Propeller feathering controls.* If propeller feathering controls are provided, there shall be a separate control for each propeller. Suitable provision shall be made to prevent inadvertent operation.

If feathering is accomplished by movement of the normal pitch or speed control lever, provision shall be made to prevent inadvertent movement of this control to the feathering position.

7.2.7.2.6 *Propeller pitch reversing controls.* If propeller pitch reversing controls are provided, there shall be a separate control for each propeller. The controls shall be grouped and arranged so as to permit separate control of each propeller and simultaneous control of all propellers, and so as to prevent inadvertent operation.

7.2.7.2.7 *Fuel jettisoning controls.* If fuel jettisoning controls are provided, they shall be protected by suitable guards to prevent inadvertent operation.

The fuel jettisoning controls shall not be located in close proximity to fire extinguisher controls or to any other controls provided to combat a fire.

7.2.7.2.8 *Carburetor air preheat controls.* If carburetor air preheat controls are provided, there shall be a separate control for each engine.

7.2.7.3 *Accessories.* Only those engine mounted accessories approved for the particular engine shall be used. They shall be mounted in the approved positions.

Items of electrical equipment subject to arcing or sparking shall be installed so as to minimize the possibility of their contact with any inflammable fluids or vapours.

7.2.7.3.1 *Battery ignition systems.* Battery ignition systems shall be supplemented by a generator automatically available as an alternative source of electrical energy, to permit continued engine operation in the event of the running down of any battery.

The capacity of batteries and generators shall be sufficient to meet simultaneously the demands of the engine ignition system and the greatest demands of the aeroplane electrical system which can be expected reasonably. These demands shall be met in cases (a), (b), and where appropriate, (c) as follows:

(a) One generator inoperative;

(b) One battery completely discharged, and the generator(s) running at normal operating speed;

(c) Where only one battery is used, the generator(s) operating at idling speed, and the battery completely discharged.

Means shall be provided to warn the appropriate members of the flight crew when malfunctioning of the electrical system is causing abnormal discharge of any battery necessary for engine ignition.

7.2.8 *Exhaust systems, induction systems, firewalls and cowling.* All exhaust systems, induction systems, firewalls and cowling shall be designed and installed so as to minimize the possibility of fire under all conditions, including those after an accident.

7.2.8.1 *Exhaust systems.* The exhaust systems shall be constructed and arranged so as to ensure the safe discharge of exhaust gases without the hazard of fire and of carbon monoxide contamination of air in personnel compartments.

Exhaust systems shall be constructed of heat and corrosion resistant materials, and shall incorporate provision to prevent failure due to expansion when heated to operating temperatures.

Exhaust manifolds shall be supported so as to withstand all vibration and inertia loads to which they may be subjected in normal conditions of operation.

Portions of exhaust systems connecting components between which relative motion may occur shall incorporate provisions for flexibility.

All exhaust system components shall be ventilated or cooled, to prevent the formation of points of excessively high temperature.

Unless suitable precautions are taken no parts of exhaust systems shall be located under portions of any systems carrying inflammable fluids which may be subject to leakage, neither shall they be located in hazardous proximity to such systems.

All aeroplane components upon which hot exhaust gases may impinge, or which may be subjected to high temperature due to proximity to exhaust system parts, shall be constructed of, or shielded with, fireproof material.

The exhaust systems shall be arranged so that there is no danger of the pilot's vision being seriously affected by glare from the exhaust.

7.2.8.1.1 *Exhaust heat exchangers.* Exhaust heat exchangers shall be constructed and installed so as to withstand without failure all vibration, inertia, and other loads, to which they may be subjected in normal conditions of operation.

Heat exchangers shall be constructed of materials suitable for continued operation at high temperatures and resistant to corrosion by products of combustion.

Provision shall be made for the inspection of all critical portions of exhaust heat exchangers.

NOTE: This applies particularly if a welded construction is employed.

Exhaust heat exchangers used for the heating of ventilating air shall be constructed so as to preclude the possibility of exhaust gases entering the ventilating air. A secondary heat exchanger shall be provided between the primary exhaust gas heat exchanger and the ventilating air system, unless it can be demonstrated that adequate safety is attained by other means.

7.2.8.1.2 *Exhaust driven turbo-superchargers.* Exhaust driven turbo-superchargers shall be of an approved type and shall be installed and supported so as to ensure their safe operation during the normal periods between inspections and overhauls.

Provision for expansion and flexibility shall be made between the exhaust conduits and the turbine.

Provision shall be made for the cooling of those turbine parts the temperatures of which are critical, and for lubrication of the turbine.

Means shall be provided for limiting the turbine speed automatically to its maximum allowable overspeed value.

7.2.8.2 *Induction systems.* The induction system shall supply an adequate quantity of air to the engine under all conditions of operation.

The induction system shall provide air in such a manner as to permit satisfactory fuel metering and mixture distribution, when the induction system valves or gates are in any normal operating position.

Each engine shall be provided with an alternative air intake, unless it can be demonstrated that equivalent safety from icing or other obstructions is attained by other means. Alternative air intakes shall be located in a sheltered position.

When air intakes open within the cowling, they shall open only within such portions as are isolated from the engine accessory section by means of a fireproof diaphragm or shoulder cowl, unless provision is made to prevent the emergence of backfire flames.

Induction system ducts ahead of the first stage of supercharging shall be provided with drains which will prevent hazardous accumulation of fuel or moisture, when the aeroplane is in the ground attitude.

Sufficient strength shall be incorporated in the ducts to prevent induction system failures resulting from backfire conditions.

NOTE: Devices which reduce the severity of the backfire conditions may be employed.

Ducts connecting components between which relative motion may occur shall incorporate provisions for flexibility.

Drains shall not discharge so as to constitute a fire hazard.

7.2.8.2.1 *Induction system anti-icing and de-icing provisions.* The induction system shall incorporate means for the prevention and for the elimination of ice accumulations. Unless it can be demonstrated that equivalent safety is attained by other means or that different values of preheating are equally effective, 7.2.8.2.1.1 shall apply.

If induction system screens are employed, they shall be located upstream from the carburettor. Screens shall not be located in portions of the induction system which constitute the only passage through which air may reach the engine unless they can be de-iced by means other than alcohol alone.

7.2.8.2.1.1 *Carburettor air preheater provisions and tests.* Where the carburettor de-icing provisions consist only of preheating the intake air, compliance with the following standards shall be demonstrated with the aeroplane operating in air free from visible moisture at a temperature of $-1.1°$ C. (30° F.).

(a) The preheaters on aeroplanes with unsupercharged engines employing conventional venturi carburettors shall be capable of providing a temperature rise of 50° C. (90° F.), when the engines are operating at 75% maximum continuous power.

(b) The preheater on aeroplanes with altitude-rated engines employing conventional venturi carburettors located ahead of the supercharger shall be capable of providing a temperature rise of 67° C. (120° F.), when the engines are operating at 60% maximum continuous power.

(c) The preheaters on aeroplanes with altitude-rated engines employing carburettors located ahead of the supercharger, and which embody features tending to reduce the possibility of ice formation, shall be capable of providing a temperature rise of 55° C. (100° F.), when the engines are operating at 60% maximum continuous power.

7.2.8.2.2 *Inter-coolers, after-coolers and after-heaters.* The ability to maintain the carburettor air intake temperature at or below the established value shall be demonstrated during cooling tests. (See 7.2.6.1.)

Inter-coolers, after-coolers and after-heaters shall have sufficient strength to withstand without failure any vibration, inertia, air and fluid pressure loads and temperature, to which they may be subjected in normal conditions of operation.

7.2.8.3 *Engine cowling.* Cowling shall be constructed and supported so as to withstand all vibration, inertia, and air loads, to which it may be subjected in normal conditions of operation.

Provision shall be made to permit rapid and complete drainage and ventilation of all portions of the cowling, with the aeroplane in all normal ground and flight attitudes.

Drains shall not discharge so as to constitute a fire hazard.

Cowling shall be constructed of fire-resistant material. Portions of cowling which are subjected to high temperatures, due to the proximity of exhaust system parts or to exhaust gas impingement shall be constructed of corrosion-resistant fireproof material.

7.2.8.3.1 *Engine accessory section diaphragms (shoulder cowls).* (See 7.2.9.4.)

7.2.9 *Fire protection.* All powerplant and other combustion equipment installations shall comply with the following fire protection standards.

7.2.9.1 *Minor crash conditions.* Means shall be provided to reduce as far as possible, the hazard of fire following a minor crash.

7.2.9.2 *Definition of designated fire zones.* Designated fire zones comprise the following regions:

Engine power section,

Engine accessory section,

Complete powerplant compartments in which no isolation is provided between the engine power section and the engine accessory section,

Auxiliary powerplant compartments,

Fuel burning heater and other combustion equipment installations.

7.2.9.3 *Firewalls.* Designated fire zones shall be isolated from the remainder of the aeroplane by means of firewalls in the form of fireproof bulkheads or shrouds. This shall not apply in the case of:

(a) Engines and auxiliary powerplants located in nacelles remote from the remainder of the aeroplane and not containing fuel tanks;

(b) Auxiliary powerplants not operated in flight;

(c) Fuel burning heater and other combustion equipment installations when an equivalent degree of safety from fires originating at these sources is provided by a particular location or by other means.

7.2.9.3.1 *Firewall construction.* The firewall shall be constructed so that no hazardous quantity of gases, and no flames, can pass from the isolated region to other portions of the aeroplane. All openings in the firewall shall be sealed with suitable close fitting fireproof grommets, bushings, or fittings. Lines passing through the firewall shall be fireproof where necessary to attain the same degree of fire protection.

7.2.9.4 *Diaphragms.* A diaphragm shall be provided in aircooled engine installations to isolate the engine power section and all portions of the exhaust system from the engine accessory section, unless equivalent fire protection can be demonstrated by other means. This diaphragm shall comply with 7.2.9.3.1.

7.2.9.5 *Other structural components.* Aeroplane surfaces aft of the nacelle in the region of one nacelle diameter on both sides of the nacelle centerline shall be constructed of fire-resistant material,

except that tail surfaces need not comply with this standard where they are not likely to be affected by flames, sparks, or heat, emanating from the nacelle.

7.2.9.6 *Fire detectors.* Fire detectors shall be provided in all designated fire zones except in fuel burning heater and other combustion equipment installations where it can be demonstrated that other means provide equivalent safety from fire.

Fire detectors shall be sufficient in number to ensure detection, and to indicate the exact region of fires.

Fire detectors shall be quick acting and shall be constructed and installed so as to resist without failure all vibration, inertia, and other loads, to which they may be subjected in normal conditions of operation.

Fire detectors shall be such as to be unaffected by exposure to oil, water, or other fluids or vapors, which may be present in designated fire zones.

7.2.9.7 *Fire extinguishing provisions.* Fire extinguishing protection shall be provided in all designated fire zones except as follows:

(a) In engine power sections where there is isolation by means of a diaphragm complying with 7.2.9.4;

(b) In any designated fire zone where it can be demonstrated that other means provide equivalent safety from fire.

7.2.9.8 *Fire Extinguishing systems.* The fire extinguishing system and the quantity of agent shall be such as to provide two adequate discharges which can be directed both separately and simultaneously to any main powerplant installation, including the induction system where fire extinguishing protection for such an induction system is necessary for compliance with 7.2.9.7; individual "one-shot" systems may be used where equivalent safety can be demonstrated fully.

Auxiliary powerplants, fuel burning heaters and other combustion equipment shall be protected by systems, which may be individual "one-shot" systems.

7.2.9.8.1 *Agent.* Methyl bromide, carbon dioxide, or any other agent which has been demonstrated to provide at least equivalent extinguishing action shall be used.

If any toxic extinguishing agent is employed, provision shall be made to prevent the entry into personnel compartments of the agent or its vapours in harmful concentrations, as a result either of leakage during normal operation of the aeroplane, or of discharging the fire extinguisher.

If carbon dioxide is used, it shall not be possible to discharge gas into personnel compartments in a quantity such that harmful concentrations result.

If methyl bromide is used, it shall be introduced into the containers in a dry state.

7.2.9.8.2 *System materials.* Components of the fire extinguishing systems located in designated fire zones shall be constructed of fireproof material, except that lines connecting components between which relative motion may occur, shall employ flexible fire-resistant coupled hose assemblies and shall be located so as to minimize the possibility of failure.

Materials in fire extinguishing systems shall not react chemically with the fire extinguishing agent so as to constitute a hazard.

7.2.9.8.3 *Containers.* Fire extinguishing agent containers shall be installed in a location where temperatures consistent with satisfactory operation of the system can be maintained.

Fire extinguishing agent containers shall be provided with a pressure relieving device to prevent bursting of the container due to excessive internal pressures.

A discharge line from the pressure relieving device shall be provided. It shall terminate outside the aeroplane in a location convenient for inspection, where there shall be incorporated a means for visual indication of any relief discharge which has taken place.

7.2.9.9 *Inflammable fluid tanks and reservoirs.* No tanks or reservoirs which are part of a system containing inflammable fluids or gases shall be located in designated fire zones, except where the fluid contained, the design of the system, the materials used in the tank, the shut-off means, all connections, lines, and controls, are such as to provide a level of safety equivalent to that of a tank located outside the designated fire zone. Adequate clearance shall be provided between any tank or reservoir located outside a designated fire zone, and a firewall, to minimize the hazard resulting from fire in any designated fire zone. These provisions need not apply to tanks, reservoirs, or accumulators, which are an integral part of the engine or propeller.

7.2.9.10 *Fluid lines and fittings.* Lines and fittings carrying inflammable fluids or gases within designated fire zones shall be fire-resistant. Where the line is upstream from a shut-off device located within a fire zone, it shall be fireproof.

All fuel lines, and lines which carry inflammable fluids under pressure, in any part of the aeroplane, when connecting components between which relative motion may occur, shall employ flexible coupled hose assemblies with fixed or detachable end fittings, instead of hose clamp assemblies.

These standards shall apply also to other lines under pressure, vent lines and drain lines, the failure of which would constitute a fire hazard or would aggravate an existing fire if the lines burned through.

7.2.9.11 *Shut-off means.* Means shall be provided to enable the appropriate members of the flight crew rapidly to shut off the flow of hazardous quantities of inflammable fluids or gases into designated fire zones. Shut-off means shall not be located within designated fire zones, unless equivalent safety is provided by the use of fireproof shut-off devices with fireproof lines.

Operation of the shut-off means shall not prevent the operation of other emergency equipment essential to the fire fighting procedure (e. g., propeller feathering).

Adequate provision shall be made to guard against inadvertent operation of any shut-off means and to enable the crew to re-open the shut-off means after closure.

7.2.9.11.1 *Controls.* All powerplant controls essential to fire fighting procedure shall be fire-resistant.

CHAPTER 8—EQUIPMENT

8.1 *Minimum equipment.* The minimum equipment installed in the aeroplane for the issuance of the certificate of airworthiness shall be that listed in (a), (b) and (c).

NOTE: Equipment additional to the minimum necessary for the issuance of a certificate of airworthiness is prescribed in Annex 6 for particular circumstances or on particular kinds of routes.

(a) *Flight and navigation instruments.* (i) An airspeed indicating system, with means of preventing malfunctioning due to icing.

(ii) An altimeter.

(iii) A magnetic compass or its equivalent.

(b) *Powerplant instruments and equipment.* (i) A carburettor air temperature indicator for each engine, where prescribed in 7.2.7.1.7.

(ii) A coolant temperature indicator for each liquid cooled engine (see 7.2.7.1.5).

(iii) A cylinder head temperature indicator for each air-cooled engine (see 7.2.7.1.6).

(iv) A fuel pressure indicator for each engine supplied by a pressure fuel system.

(v) Fuel quantity indicators as prescribed in 7.2.7.1.1.

(vi) A fuel flowmeter or a fuel/air ratio indicator for each engine not equiped with an automatic mixture control (see 7.2.7.1.2).

(vii) A manifold pressure indicator for each engine where the proper control of engine power necessitates the use of such indicators.

(viii) An oil pressure indicator for each engine.

(ix) Oil quantity indicators as prescribed in 7.2.7.1.3.

(x) An oil temperature indicator for each engine (see 7.2.7.1.4).

(xi) A tachometer (crankshaft rotational speed indicator) for each engine.

(xii) Fire warning indicators for the fire detectors prescribed in 7.2.9.6.

(xiii) Ignition switches for each engine (see 7.2.7.2.2).

(c) *Miscellaneous equipment.* (i) Safety belts for all occupants (see 4.6).

(ii) A portable fire extinguisher (see 8.2.2.1).

(iii) All additional items of equipment necessary for compliance with the standards of Part III, which are not specifically listed in 8.1.

8.2 *Installation of equipment.* It shall be established that the minimum equipment prescribed in 8.1 and any additional equipment which may be necessary for compliance with the standards of annex 6 will function adequately and reliably when installed in the aeroplane.

Where equipment other than that prescribed in 8.1 or by the standards of annex 6 is installed, it shall be demonstrated that the equipment as installed is neither a source of danger in itself, nor a prejudice to the proper functioning of any essential service, and will not in any way impair the airworthiness of the aeroplane in which it is fitted even if the equipment fails to function.

8.2.1 *Instruments.*

8.2.1.1 *Arrangement and visibility of instruments.* Those flight, navigation and powerplant instruments which are used by each pilot shall be arranged so as to permit the pilot to see them readily from his station, with the minimum practicable deviation from the position and line of vision which he normally assumes when looking forward along the flight path.

All the prescribed flight instruments shall be grouped conveniently and, as nearly as is practicable, disposed symmetrically about the vertical plane which includes the line of vision normally assumed by the pilot when looking forward along the flight path.

All the prescribed powerplant instruments shall be grouped conveniently on instrument panels, in a manner such that the appropriate members of the flight crew can see them readily. Identical powerplant instruments for the several engines shall be located so as to prevent any misleading impression regarding the engines to which they relate.

NOTE: For detailed powerplant instrument standards see 7.2.7.1.

8.2.1.2 *Instrument panel vibration characteristics.* The vibration characteristics of instrument panels shall not be such as to impair the accuracy of the instruments, or to cause damage to them.

8.2.1.3 *Instrument illumination.* When illumination of instruments and equipment is provided in order to comply with the standards of annex 6, there shall be sufficient illumination to make all instruments, and appropriate placards and equipment easily readable and discernible by night. Instrument lights shall be installed in a manner such that the pilot's eyes are shielded from their direct rays and that no objectionable reflections are visible to him.

8.2.1.4 *Airspeed indicating systems.* The airspeed indicating system shall be calibrated in flight to determine the total error of the system, i. e., the difference between IAS and CAS. Data showing the magnitude of the error at various speeds shall be given in the Aeroplane Flight Manual.

8.2.1.5 *Static air pressure vent systems.* All instruments having static air pressure connections shall be vented in a manner such that aeroplane speed, attitude, and configuration, opening and closing of windows, moisture or other foreign matter, will not affect their accuracy seriously.

8.2.1.6 *Instruments requiring a power supply.* Mandatory instruments requiring a power supply (e. g., gyroscopic instruments) shall be provided with at least two independent sources of power.

8.2.1.7 *Duplicate instruments.* When any instrument is duplicated (e. g., an airspeed indicator or an altimeter) in order to comply with the standards of annex 6, two operating systems independent from each other shall be provided.

8.2.2 *Safety equipment.* Prescribed safety equipment which the crew is expected to operate at the time of an emergency, shall be accessible readily, and its method of operation shall be marked plainly. When such equipment is carried in compartments, or containers, the compartments or containers shall be marked to identify the contents for the benefit of passengers and crew.

8.2.2.1 *Fire extinguishers.* The portable fire extinguisher prescribed in 8.1 (c) (ii) shall be located and installed so that it can be used conveniently by the pilot and co-pilot.

8.2.2.2 *Rafts and life preservers.* When rafts and life preservers are provided in order to comply with the standards of annex 6, they shall be installed so as to be available readily to the crew and passengers. When rafts are installed so that they may be released automatically or by remote control, they shall remain attached to the aeroplane by means of a line after such automatic or remote control has operated.

RECOMMENDATION: The strength of the attachment line should be such that the line would break before capsizing or submerging the loaded raft.

8.2.2.3 *Signaling devices.* When signaling devices are provided in order to comply with the standards of annex 6, they shall be accessible, shall function satisfactorily, and shall be free from hazard in their operation.

8.2.3 *Navigation lights.* When navigation lights are provided in order to comply with the standards of annex 6, they shall comply with the standards of 8.2.3.

NOTE: The term "Navigation Lights", as used in 8.2.3, refers to the lights prescribed in paragraph 4.1.1 of the standards for the rules of the air in annex 2. See this annex for the other lights to be displayed on board an aeroplane in particular circumstances (seaplanes and amphibians on the surface of the water).

Navigation lights complying with 8.2.3 shall be deemed to comply with the standards for the rules of the air in annex 2.

8.2.3.1 *Definitions*—(a) *Longitudinal axis.* For the purpose of 8.2.3, the longitudinal axis of the aeroplane is a selected axis parallel to the direction of flight at a normal cruising speed, and passing through the center of gravity of the aeroplane.

(b) *Horizontal and vertical planes.* For the purpose of 8.2.3:

(i) The horizontal plane is the plane containing the longitudinal axis and perpendicular to the plane of symmetry of the aeroplane;

(ii) Vertical planes are planes perpendicular to the horizontal plane defined in (i).

(c) *Dihedral angles.* The three dihedral angles referred to in 8.2.3 as dihedral angle *L*, dihedral angle *R* and dihedral angle *A* are as follows:

(i) Dihedral angle *L* is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other at 110° to the left of the first, when looking forward along the longitudinal axis.

(ii) Dihedral angle *R* is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other at 110° to the right of the first, when looking forward along the longitudinal axis.

(iii) Dihedral angle *A* is formed by two intersecting vertical planes making angles of 70° to the right and 70° to the left respectively, looking aft along the longitudinal axis, to a vertical plane passing through the longitudinal axis.

8.2.3.2 *Signals to be emitted by lights.* The signals emitted by navigation lights shall comply either with 8.2.3.2.1 or with 8.2.3.2.2.

8.2.3.2.1 *Steady lights.* If steady lights are used:

(a) The signal emitted within dihedral angle *R* shall be a green light;

(b) The signal emitted within dihedral angle *L* shall be a red light;

(c) The signal emitted within dihedral angle *A* shall be a white light.

8.2.3.2.2 *Flashing lights.* If flashing lights are used, the signal in any direction shall consist of a sequence of identical cycles automatically repeated. The frequency shall be not less than 36 and not more than 60 cyces per minute.

8.2.3.2.2.1 *Starboard signal.* A cycle of the signal emitted within dihedral angle *R* shall consist of a flash of green light followed by a flash of white light; the flashes shall be approximately equal in duration.

NOTE: The signal may be obtained by a lamp producing a flashing white light mounted close to a lamp producing a steady green light, the white light being of sufficient intensity to make the green light appear to flash alternately with the white light.

8.2.3.2.2.2 *Port signal.* A cycle of the signal emitted within dihedral angle *L* shall consist of a flash of red light followed by a flash of white light; the flashes shall be approximately equal in duration.

NOTE: The signal may be obtained by a lamp producing a flashing white light mounted close to a lamp producing a steady red light, the white light being of sufficient intensity to make the red light appear to flash alternately with the white light.

8.2.3.2.2.3 *Astern signal.* A cycle of the signal emitted within dihedral angle *A* shall consist of either:

(a) Two successive flashes of white light approximately equal in duration; or,

(b) A flash of white light followed either by simultaneous flashes of red and white lights vertically separated, or by a flash of red light; the duration of the white flash shall be equal approximately to that of the coloured flash.

8.2.3.2.2.4 *Synchronization of signals.* The cycles of the three signals prescribed in 8.2.3.2.2, shall be of equal duration.

The coloured portions of the port and starboard signals shall be synchronized with one of the white flashes of the astern signal specified in 8.2.3.2.2.3 (a), or with the white flash of the astern signal specified in 8.2.3.2.2.3 (b), whichever is appropriate.

The ratio of any period when no lights are on to the flash period shall not exceed 0.30.

8.2.3.2.3 *Location of light sources.* Light sources shall be located so that they will not cause glare objectionable to the pilot.

NOTE: Each signal may be produced either by a signal lamp, or by a combination of lamps mounted on one or more parts of the structure.

8.2.3.2.4 *Wing clearance lights.*

RECOMMENDATION: If there are no navigation lamps within 1.80 meters (6 feet) of the wing tips, wing clearance lights should be provided at the wing tips. The port light should be red and should be confined to dihedral angle *L*. The starboard light should be green and should be confined to dihedral angle *R*. These lights should be steady.

8.2.3.3 *Color.*

8.2.3.3.1 *Color specifications.* The colors prescribed in 8.2.3.2, expressed in terms of the chromaticity coordinates recommended by the International Commission on Illumination shall be as follows: (See fig. 8-1).

(a) *Red.*

y not greater than 0.335.
z not greater than 0.015.

(b) *Green.*

x and y within an envelope defined as follows:

From the minimum value of x corresponding with $y=0.390-0.170\ x$ the following straight lines shall be drawn, each being stopped at its intersection with the next one:

$y=0.390-0.170x$
$x=y-0.170$
$y=0.380$
$x=0.410y+0.100$
$x=0.290$ extended up to the maximum value of y corresponding with $x=0.290$.

(c) *White.*

x not less than 0.300 and not greater than 0.540
y not less than $x-0.040$ or $y_0-0.010$ whichever is the smaller and
y not greater than
(i) $x+0.020$ for x not greater than 0.440, and than
(ii) $y_0+0.010$ for x greater than 0.440
where y_0 is the y coordinate of the Planckian radiator for the value of x considered.

8.2.3.3.2 *Determination of color.* The determination of the color of the light emitted by navigation lights shall be made with the light source operating at the average efficiency corresponding with the normal operating voltage of the aeroplane.

8.2.3.4 *Intensity.*

NOTE: The unit of intensity used is the international candle.

8.2.3.4.1 *General.* When the signal is composed of two colors, the ratio of the intensities of the two colors in any direction shall be not less than 0.1.

NOTE: Greater minimum ratios may be needed in certain directions to comply with 8.2.3.4.2.

For the purpose of 8.2.3.4 the intensity of such signal shall be that of the color of higher intensity.

8.2.3.4.2 *Intensities in horizontal plane.* The intensity in any direction in the horizontal plane shall be not less than the values given in table 8-I. (See also fig. 8-2a.)

TABLE 8-I—MINIMUM INTENSITIES IN THE HORIZONTAL PLANE

Dihedral angle	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity
		Candles
I and *R*	0 degrees to 10 degrees	40
	10 degrees to 20 degrees	30
	20 degrees to 110 degrees	20
A	110 degrees to 180 degrees	20

Within dihedral angles *L* and *R* the intensity of the colour of lower intensity shall be not less than 5 candles in any direction in the horizontal plane.

8.2.3.4.3 *Intensities above and below horizontal.* The intensity in any direction in any vertical plane shall not be less than the appropriate value given in table 8-II, where "I" is the minimum intensity prescribed in 8.2.3.4.2 for the direction in the horizontal plane determined by the intersection of the horizontal plane and the vertical plane for which the distribution is prescribed. (See also fig. 8-2b.)

TABLE 8-II—MINIMUM INTENSITIES IN ANY VERTICAL PLANE

Angle above or below horizontal:	*Intensity*
0 degrees	1.00 "I"
0 degrees to 5 degrees	.90 "I"
5 degrees to 10 degrees	.80 "I"
10 degrees to 15 degrees	.70 "I"
15 degrees to 20 degrees	.50 "I"
20 degrees to 30 degrees	.30 "I"
30 degrees to 40 degrees	.10 "I"

NOTE: No minimum specifications have been established for angles greater than 40 degrees.

8.2.3.4.4 *Overlaps between adjacent signals.* The intensities in overlaps between adjacent signals in the horizontal plane shall not exceed the values given in table 8-III.

TABLE 8-III—MAXIMUM INTENSITIES IN OVERLAPPING BEAMS OF NAVIGATION LIGHTS

Overlaps	Overlap angle	Maximum intensity
		Candles
Green in dihedral angle *L*	10° to 20°	10
	Beyond 20°	1
Red in dihedral angle *R*	10° to 20°	10
	Beyond 20°	1
Green in dihedral angle *A*	10° to 20°	5
	Beyond 20°	1
Red in dihedral angle *A*	10° to 20°	5
	Beyond 20°	1
Rear white or rear red in dihedral angle *L*.	10° to 20°	5
	Beyond 20°	1
Rear white or rear red in dihedral angle *R*.	10° to 20°	5
	Beyond 20°	1

NOTE: Until specific standards are developed, comparable overlaps in other directions are permitted.

8.2.3.4.5 *Intensity of wing clearance lights.*

RECOMMENDATION: The intensity of the wing clearance lights recommended in 8.2.3.2.4 should not be less than 2 candles.

8.2.3.4.6 *Determination of intensity.* The intensities prescribed are those to be provided by new equipment with all filters and covers in place. Intensities shall be determined with the light source operating at a steady value equal to the average luminous output of the light source at the normal operating voltage of the aeroplane.

8.2.3.5 *Light covers and colour filters.* Any covers or colour filters used shall be of noncombustible material and shall be constructed so that they will not change colour or shape or suffer any appreciable loss of light transmission during normal use.

8.2.4 *Electrical systems.* Electrical systems and equipment:

(a) Shall be free from hazard in themselves, in their method of operation, and in their effects on other parts of the aeroplane;

(b) Shall be installed in a manner such that they are suitably protected from fuel, oil, water, and detrimental substances, and from mechanical damage.

8.2.5 *Hydraulic systems.* Hydraulic systems shall be such that when subjected to the proof pressure tests prescribed herein no part of the hydraulic system fails, functions badly, or experiences detrimental permanent deformation. At least one system of a given type shall be subjected to such a proof pressure test.

The test pressure shall be that corresponding with the maximum operating pressure, increased by an adequate margin (normally 30%) to take into account conditions such as the following:

(a) Variability of the hydraulic lines and other parts;

(b) The extent of the hazard which would result from failure.

8.2.5.1 *Lines.* All hydraulic lines and fittings carrying inflammable fluid within a designated fire zone shall be constructed in accordance with 7.2.9.10 and shall be provided with shut-off means as prescribed in 7.2.9.11.

8.2.5.2 *Accumulators and reservoirs.* The location of hydraulic accumulators and pressurized reservoirs shall comply with the provisions of 7.2.9.9.

8.2.6. *Automatic pilot systems.* If an automatic pilot system is installed:

(a) It shall be possible under all conditions of flight, for the human pilot to resume control of the aeroplane rapidly and easily without continued interference from the automatic pilot;

(b) Where no automatic synchronization is provided a satisfactory means shall be provided to indicate readily to the pilot the position of the actuating device in relation to the control system which it operates;

(c) The inherent characteristics of the automatic pilot as installed and adjusted shall be related to the strength of the aeroplane so that the automatic pilot will not, at any speed at which it is permitted to be used, apply the controls in a manner which will cause detrimental deformation in any part of the aeroplane.

The maximum aeroplane speed at which the automatic pilot is permitted to be used shall be given in the Aeroplane Flight Manual.

RECOMMENDATION: The automatic pilot installation should be designed so that no single failure, the possible occurrence of which can be foreseen, can lead to the automatic pilot rapidly promoting a dangerous attitude of the aeroplane or of the controls.

8.2.7 *Aeroplane accessories (engine driven).* The failure of any one engine shall not impair the functioning of equipment so as to render the operation of the aeroplane unsafe.

CHAPTER 9—OPERATING LIMITATIONS AND INFORMATION

9.1 *General.* The operating limitations, upon the basis of which the certificate of airworthiness is issued shall be established as prescribed in 9.2. These operating limitations, together with any other information concerning the aero-

plane, necessary for safety during operation, shall be made available to appropriate members of the flight crew by means of an Aeroplane Flight Manual (as prescribed in 9.3), markings and placards (as prescribed in 9.4), and such other means as may be necessary to accomplish this purpose.

9.2 *Operating limitations.* The operating limitations shall include those prescribed in 9.2.1 to 9.2.9, inclusive, unless the design of the aeroplane is such that they are unnecessary for safe operation.

9.2.1 *Loading limitations.* The loading limitations shall include limitations on:

(a) Weights (see 2.2);
(b) Centers of gravity (see 2.2);
(c) Weight distributions (see 2.2).

9.2.2 *Airspeed limitations.* The airspeed limitations shall include those prescribed in 9.2.2.1 to 9.2.2.7, inclusive.

These airspeed limitations shall be expressed as airspeed indicator readings, IAS, or, when the total error of the airspeed indicating system is confined to reasonable limits, as calibrated airspeed, CAS.

NOTE: The design speeds, whenever used in 9.2.2 as a basis for determining the airspeed limitations, are assumed to be converted from EAS to IAS or CAS whichever is appropriate.

If the speeds defined in 9.2.2.1 to 9.2.2.7, inclusive, are a function of altitude or Mach number, weight, and weight distribution, the limitations shall correspond with critical combinations of all variables.

9.2.2.1 *Never exceed speed, V_{NE}.* A speed sufficiently below V_D, the design diving speed, chosen in accordance with 3.2, or V_{DF}, the demonstrated flight diving speed (see 2.5), whichever is the lesser, to allow for possible variations in aeroplane characteristics and to minimize the possibility of exceeding inadvertently either of these two speeds.

In the absence of an investigation substantiating another value, V_{NE} shall not exceed 0.9 times the lesser of V_D or V_{DF}.

9.2.2.2 *Normal operating limit speed, V_{NO}.* A speed which shall not exceed V_C, the design cruising speed, chosen in accordance with 3.2, and sufficiently below V_{NE} to make it unlikely that V_{NE} would be exceeded in a moderate upset occurring at V_{NO}.

In the absence of an investigation substantiating another value, V_{NO} shall not exceed 0.9 V_{NE}.

9.2.2.3 *Maneuvering speed.* A speed, which shall not exceed V_A, the design maneuvering speed, chosen in accordance with 3.2.

9.2.2.4 *Wing flaps extended speed.* A speed which shall be the lesser of the speeds for which the areoplane and wing flap structure has been proven in accordance with 3.3.2.

This speed shall be the limiting speed for operation at any position of the wing flaps other than the fully retracted position, except that other limiting speeds may be established for specific wing flap positions and associated values of engine power if the structure has been proven for the corresponding design conditions.

9.2.2.5 *Landing gear operating speed.* The maximum speed at which it has been demonstrated that it is safe to extend or retract the landing gear, as limited by the design strength (see 4.3.1.2) or by flight characteristics.

9.2.2.6 *Landing gear extended speed.* The maximum speed at which it has been demonstrated that the aeroplane can be flown safely with the landing gear fully extended, and for which the structure has been proven.

9.2.2.7 *Automatic pilot speed.* The maximum speed at which the automatic pilot is suitable for use in accordance with 8.2.6.

9.2.3 *Altitude limitations.* The altitude limitations shall be the maximum operating altitude, that is, the maximum altitude at which operation is permitted.

9.2.4 *Load factor limitations.* The load factor limitations shall be the maneuvering flight load factors.

The maneuvering flight load factors shall not be greater than the limit positive load factors determined from the flight maneuvering V–n diagram (see 3.3.1.1).

9.2.5 *Powerplant limitations.* The powerplant limitations shall include those prescribed in (a) to (d), inclusive, and shall not exceed the corresponding limits established as a part of the type approval of the engine and propeller installed in the aeroplane.

(a) *Take-off operation.* (i) Maximum crankshaft rotational speed.

(ii) Maximum permissible manifold pressure.

(iii) Maximum allowable oil inlet and cylinder head or coolant outlet, temperatures.

(iv) The time limit upon the use of the corresponding power.

(b) *Maximum continuous operation.* (i) Maximum crankshaft rotational speed.

(ii) Maximum permissible manifold pressure.

(iii) Maximum allowable oil inlet, and cylinder head or coolant outlet, temperatures.

(c) *Maximum weak mixture operation.* (i) Maximum crankshaft rotational speed.

(ii) Maximum permissible manifold pressure.

(iii) Maximum allowable oil inlet, and cylinder head or coolant outlet, temperatures.

(d) *Fuel octane rating.* The minimum octane rating of fuel necessary for satisfactory operation of the powerplant at the limits defined in 9.2.5.

9.2.6 *Outside air temperature limitations.* The outside air temperature limitations shall be the maximum anticipated air temperatures at which it has been shown that the aeroplane complies with the engine cooling standards (see 7.2.6 and 7.2.6.1).

9.2.7 *Crosswind limitations (landplanes).* The crosswind limitation for landplanes shall be the crosswind established in compliance with 2.6.3, if such crosswind has been found to be critical.

9.2.8 *Wind and water condition limitations (seaplanes).* The wind and water condition limitations for seaplanes shall be all combinations of wind and water conditions which have been found to be critical in establishing compliance with 2.7.1.

9.2.9 *Flight crew limitations.* The minimum flight crew shall be the minimum number of persons necessary for the safe operation of the aeroplane during visual flight by day.

9.3 *Aeroplane flight manual.* An Aeroplane Flight Manual shall be furnished with each aeroplane.

The Manual shall contain, as a minimum, the items prescribed in 9.3 and at least these portions of the Manual shall be verified and approved.

Additional items of information, having a direct and important bearing on safe operation, shall be included when unusual design, operating, or handling characteristics so warrant.

The Manual shall contain a statement to the effect that the aeroplane has been certificated in the Transport Category "A", upon the basis of compliance with the international Airworthiness Standards.

9.3.1 *Identification data.* The following identifying information, by means of which the Manual is related to the aeroplane with which it corresponds, shall be given:

(a) Nationality and registration marks of the aeroplane;
(b) Name and address of the manufacturer;
(c) Date and place of construction;
(d) Type and serial number of the aeroplane;
(e) Over-all dimensions of the aeroplane;
(f) Number of engines and type;
(g) Number of propellers and type.

9.3.2 *Eligibility for particular types of operation.* There shall be included a list of the particular types of operation defined in the standards of annex 6, for which the aeroplane has been shown to be eligible by virtue of compliance with the relevant airworthiness standards, and a list of the mandatory equipment (as prescribed in the standards of annex 6) for any such type of operation.

9.3.3 *Operating limitation information.* Information shall be given on such of the operating limitations of (a) to (h), inclusive, as are appropriate to the aeroplane type, together with an explanation of the significance of each limitation.

An explanation shall also be given of the instrument markings and of any color coding used.

(a) Airspeed information and limitations: (i) Airspeed indicator calibration data (see 8.2.1.4).

(ii) The never exceed speed (see 9.2.2.1).

(iii) The normal operating limit speed (see 9.2.2.2), together with a statement to the effect that cruising flight operations should be confined to speeds below this speed, and a further statement to the effect that the range of speeds lying between the never exceed speed and the normal operating limit speed should not be entered intentionally unless the pilot has due regard to the prevailing flight and atmospheric conditions.

(iv) The maneuvering speed (see 9.2.2.3), together with a statement to the effect that maneuvers involving an approach to a stall or involving full application of rudder or aileron control

should be confined to speeds below this value.

(v) The wing flap extended speeds (see 9.2.2.4).

(vi) The landing gear operating speed (see 9.2.2.5).

(vii) The landing gear extended speed (see 9.2.2.6).

(viii) The automatic pilot speed (see 9.2.2.7).

(ix) When an airspeed operating limitation is based on compressibility effects, an appropriate statement together with information as to any symptoms, the probable behaviour of the aeroplane, and recommended recovery procedures.

(b) The maximum operating altitude (see 9.2.3), together with an explanation of the factors which establish the maximum operating altitude.

(c) The maneuvering flight load factors (see 9.2.4), together with a statement to explain the significance of the maneuvering flight load factors indicating that intentional maneuvers should be confined to load factors well below the maximum quoted values.

The acrobatic maneuvers limitations, that is, a prohibition of all intentional acrobatic maneuvers, together with a statement that stalling necessary for tests and pilot instruction is not thereby prohibited.

(e) The powerplant operating limitations (see 9.2.5), together with a statement to the effect that fuel remaining in tanks when the quantity indicator reaches zero cannot be used safely in flight.

(f) The outside air temperature limitations (see 9.2.6).

(g) The critical crosswind for landplanes (see 9.2.7).

(h) The critical combinations of wind and water conditions, for seaplanes (see 9.2.8).

9.3.4 *Operating procedures.* Information of the nature indicated in (a), (b), and (c) shall be included insofar as such information is peculiar to the type of aeroplane, and is necessary for the safe performance of normal and emergency procedures by the crew:

(a) A discussion of any significant or unusual flying or ground handling characteristics, knowledge of which would be useful to a pilot who has not previously flown the aeroplane, and would assist him to fly safely;

(b) Information and instructions regarding such features as starting and warming of engines, taxying, and operation of wing flaps, landing gear and automatic pilot;

(c) An outline of the procedure to be used in the event of failure of one or more engines, including at least minimum speeds recommended, trim, feathering of propellers, and operation of remaining engines.

9.3.5 *Performance information.* A summary shall be given of all performance data secured in accordance with 2.3, as well as all data which have been derived therefrom for use when the aeroplane is operated in accordance with the standards of annex 6.

This information shall include:

(a) Adequate identification of the aeroplane configuration and the pertinent values of airspeed upon which the data are based;

(b) Adequate instructions to enable the flight crew to obtain the appropriate configurations and airspeeds;

(c) A discussion of any significant or unusual characteristics of the aeroplane which might have an important bearing on the ability of the flight crew to obtain such performance.

9.3.6 *Loading instructions.* The aeroplane weight and centre of gravity limits, and the weight empty, determined in accordance with 2.2, shall be recorded.

Where the variety of possible loading so warrants, instructions adequate to enable observance of the relevant operating limitations shall be given.

9.3.7 *Minimum flight crew.* The minimum flight crew (see 9.2.9), shall be recorded.

9.4 *Markings and placards.* Placards shall be displayed in a conspicuous place. Markings and placards shall be such that they are not easily erased, disfigured, or obscured. At least those prescribed in 9.4 shall be provided.

9.4.1 *Instrument markings and placards.* The information prescribed in 9.4.1.1 to 9.4.1.4, inclusive, shall be marked on the appropriate instrument or stated on an adjacent placard, as prescribed in each case.

When markings are placed on the cover glass of the instrument, adequate provisions shall be made to maintain the correct positioning of the cover glass with the dial. All arcs and lines shall be of sufficient width, and shall be located so as to be clearly and easily visible to the appropriate members of the flight crew.

9.4.1.1 *Airspeed indicators.* Either color marking or placards shall be provided to show the following airspeed limitations (see 9.2.2):

(a) Never exceed speed (see 9.2.2.1);

(b) Normal operating limit speed (see 9.2.2.2);

(c) Wing flaps extended speeds (see 9.2.2.4);

(d) Landing gear operating speed (see 9.2.2.5);

(e) Landing gear extended speed (see 9.2.2.6);

NOTE: Where color marking is used, it is suggested that the colors conform to the scheme given herewith:

(a) *Never exceed speed.* A red radial line.

(b) *The caution range.* A yellow arc extending from the red line in (a) to the upper limit of the green arc of (c).

(c) *The normal operating range.* A green arc with the lower limit at V_{s_1} as determined in accordance with 2.3.2 with maximum take-off weight, landing gear and wing flaps retracted, and the upper limit at the normal operating limit speed established in 9.2.2.2.

(d) *The wing flap operating range.* A white arc with the lower limit at V_{s_0} as determined in accordance with 2.3.2 at the maximum landing weight, and the upper limit at the speed established in accordance with 9.2.2.4.

When the never exceed speed and normal operating limit speed vary with altitude or weight and weight distribution, means shall be provided to indicate to the pilot the appropriate limitations for critical combinations of these variables.

9.4.1.2 *Magnetic compass.* A card shall be installed on, or adjacent to, each magnetic compass indicator, and shall give the deviations (errors) of the installation in the level flight attitude with engines operating. It shall be stated whether the errors correspond with the radio receivers "On" or "Off".

The deviations shall be stated with reference to known magnetic headings at intervals of not more than 45 degrees.

9.4.1.3 *Powerplant instruments.* All prescribed powerplant instruments shall be marked or placarded with the maximum and (where applicable) minimum indications for safe operation.

NOTE: Where colour marking is used, it is suggested that the colours conform to the scheme given herewith:

(a) *Maximum and minimum indications for safe operation.* A red radial line.

(b) *Normal operating ranges.* A green arc extending from the maximum to the minimum limits for continuous operation.

(c) *Take-off and precautionary ranges.* A yellow arc.

9.4.1.4 *Fuel quantity indicators.* Where any tank is found to contain an unusable fuel supply, a red arc shall be marked on the indicator and shall extend from the bottom of the scale to the calibrated zero reading (see 7.2.7.1.1 and 7.2.4.3).

9.4.2 *Control markings.* With the exception of the primary flight controls, all controls essential to the safe operation of the aeroplane shall be plainly marked as to their function and method of operation.

9.4.2.1 *Secondary flight controls.* The secondary flight controls shall be marked to comply with 4.2.3 and 4.2.4.

9.4.2.2 *Powerplant fuel controls.* (a) Controls for fuel tank selector valves shall be marked to indicate the position corresponding with each tank and any cross feed positions.

(b) Where more than one fuel tank is provided, and if safe operation depends upon the use of tanks in a specific sequence, the fuel tank selector controls shall be marked to indicate to the flight crew the order in which the tanks shall be used.

(c) Controls for engine selector valves shall be marked to indicate the position corresponding with each engine.

(d) The capacity of each tank shall be indicated at the fuel tank selector control.

9.4.2.3 *Inflammable fluid emergency controls.* Emergency controls such as fuel jettisoning and fluid shut-off controls shall be clearly marked to indicate their functions and methods of operation.

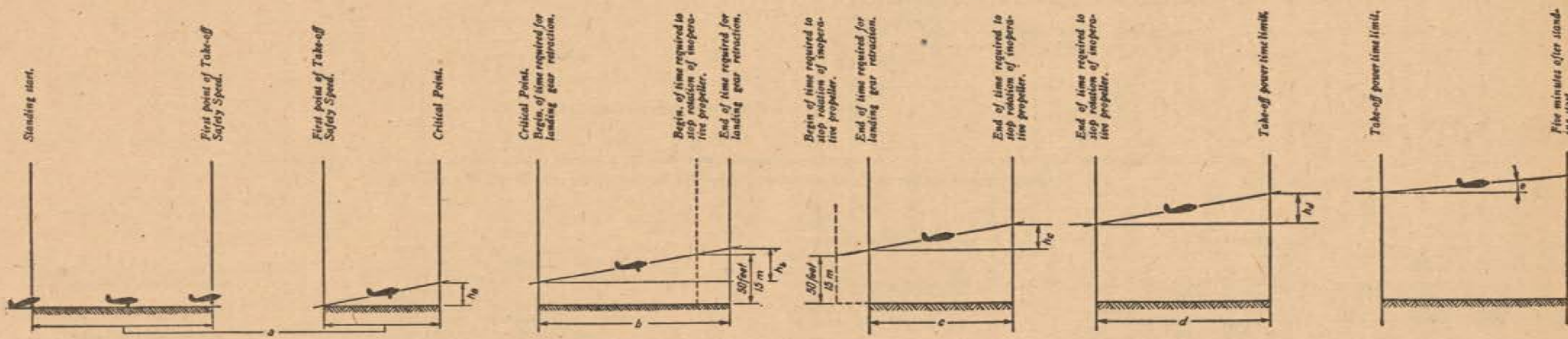
9.4.3 *Miscellaneous markings and placards.*

9.4.3.1 *Cargo compartments and ballast location.* Each cargo compartment and ballast location shall bear a placard which states the maximum allowable weight of contents and, if applicable, any special limitations concerning intensity and distribution of loading.

9.4.3.2 *Fuel, oil, and coolant filler openings.* (See 7.2.4.5, 7.2.5.2, and 7.2.6.1.2.)

9.4.3.3 *Emergency exits.* (See 4.5.2.5.)

9.4.3.4 *Smoking.* (See 4.10.)



Element a_1.

Aeroplane speed and configuration.

1. Flight path speed accelerating from zero to Take-off Safety Speed.

2. Landing gear fully extended.

3. Wing flaps in take-off position.

4. All engines operating within maximum take-off power limitations.

Element a_2.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.

2. Landing gear fully extended.

3. Wing flaps in take-off position.

4. All engines operating within maximum take-off power limitations.

Element b.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.

2. Landing gear fully extended.

3. Wing flaps in take-off position.

4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.

5. Inoperative propeller windmilling.

6. Control of inoperative propeller in recommended take-off position.

Element c.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.

2. Landing gear fully retracted.

3. Wing flaps in take-off position.

4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.

5. Inoperative propeller windmilling.

6. Control of inoperative propeller in recommended take-off position.

Element d.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.

2. Landing gear fully retracted.

3. Wing flaps in take-off position.

4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.

5. Inoperative propeller stopped.

Element e.

Aeroplane configuration.

1. Landing gear fully retracted.

2. Wing flaps in take-off position.

3. Critical engine inoperative, operating engine(s) within maximum continuous power limitations.

4. Inoperative propeller stopped.

Fig. 2—1a.—*Take-off path elements with the Critical Point later than first point of Take-off Safety Speed.*

In this example, the end of time required to stop rotation of the inoperative propeller occurs later than the end of time required for the landing gear retraction.

Items of take-off path elements to be determined.

Horizontal distances:
a, b, c, d,

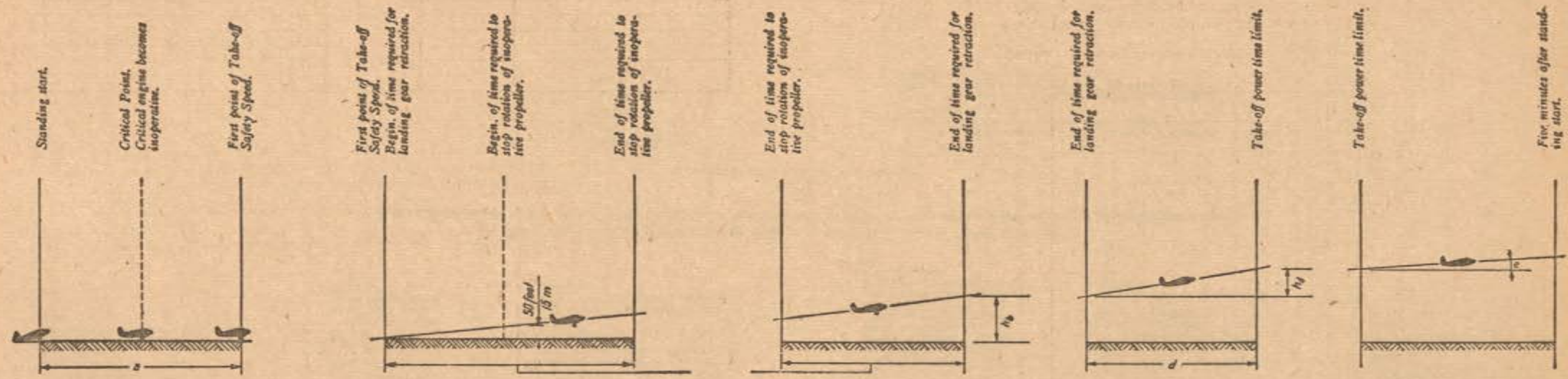
Heights:
h_a, h_b, h_c, h_d

Slopes:
e.

Time intervals:

Time required to retract the landing gear. Retraction initiated at Critical point or First point of Take-off Safety Speed whichever occurs later.

Time required to stop the rotation of the inoperative propeller. Stopping of propeller rotation initiated after a height of 50 feet (15 metres) has been attained.



Element a.

Aeroplane speed and configuration.

1. Flight path speed accelerating from zero to Take-off Safety Speed.
2. Landing gear fully extended.
3. Wing flaps in take-off position.
4. Operating engine(s) within maximum take-off power limitations.

Element b_1.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.
2. Landing gear fully extended.
3. Wing flaps in take-off position.
4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.
5. Inoperative propeller windmilling.
6. Control of inoperative propeller in recommended take-off position.

Element b_2.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety Speed.
2. Landing gear fully extended.
3. Wing flaps in take-off position.
4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.
5. Inoperative propeller stopped.

Element d.

Aeroplane speed and configuration.

1. Flight path speed equals Take-off Safety speed.
2. Landing gear fully retracted.
3. Wing flaps in take-off position.
4. Critical engine inoperative, operating engine(s) within maximum take-off power limitations.
5. Inoperative propeller stopped.

Element e.

Aeroplane configuration.

1. Landing gear fully retracted.
2. Wing flaps in take-off position.
3. Critical engine inoperative, operating engine(s) within maximum continuous power limitations.
4. Inoperative propeller stopped.

Fig. 2—1 b.—*Take-off path elements with the Critical Point earlier than first point of Take-off Safety Speed.*

In this example the end of time required to stop rotation of the inoperative propeller occurs earlier than the end of time required for the landing gear retraction.

Items of take-off path elements to be determined.

Horizontal distances:
a, b, d.

Heights:
h_y, h_z

Slopes:
e.

Time intervals:

Time required to retract the landing gear. Retraction initiated at Critical Point or First point or Take-off Safety Speed whichever occurs later.

Time required to stop the rotation of the inoperative propeller. Stopping of propeller rotation initiated after a height of 50 feet (15 metres) has been attained.

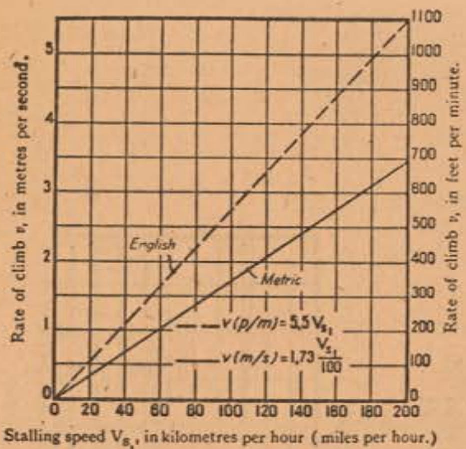


FIGURE 2-2. Recommended minimum steady rate of climb at 1,500 metres (5,000 feet) altitude, en route, all engines operating.

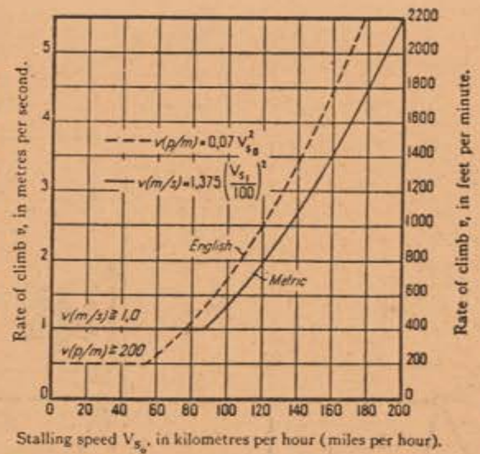


FIGURE 2-3. Recommended minimum steady rate of climb for balked landing, all engines operating.

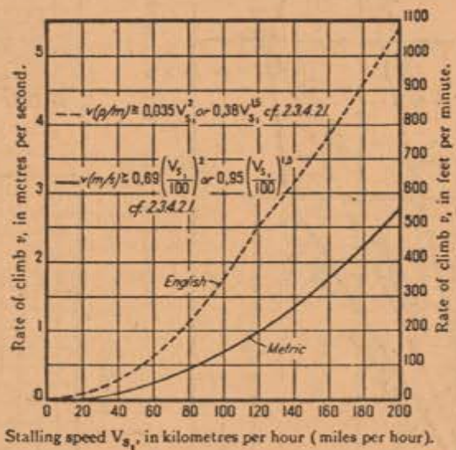


FIGURE 2-4. Recommended minimum steady rate of climb for take-off, one engine inoperative.

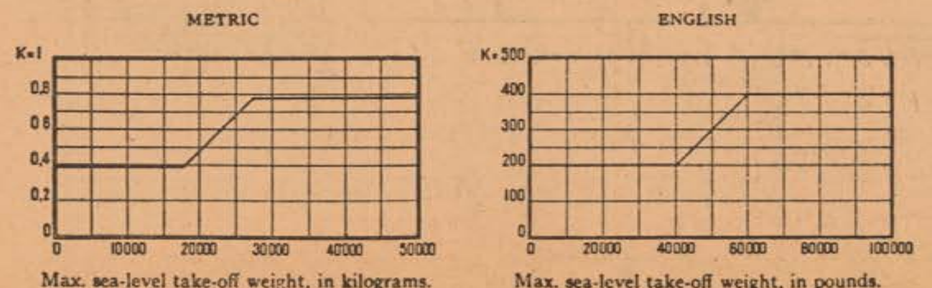


FIGURE 2-5a. Factor *K*.

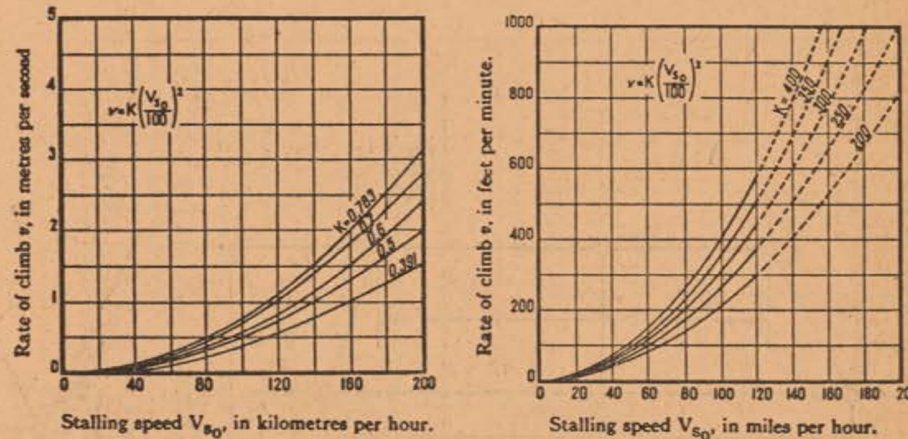


FIGURE 2-5b. Recommended minimum steady rate of climb at 1,500 metres (5,000 feet) altitude, enroute, one engine inoperative.

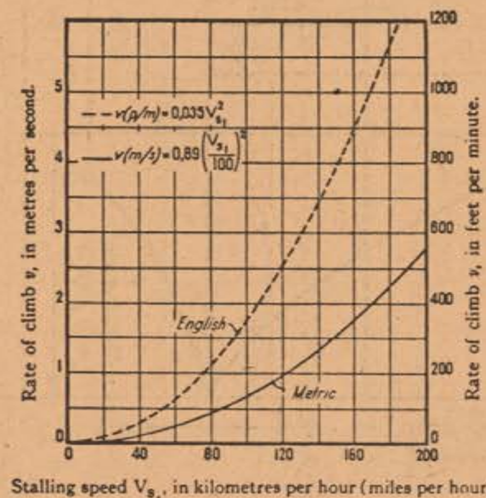


FIGURE 2-6. Recommended minimum steady rate of climb, for approach, one engine inoperative.

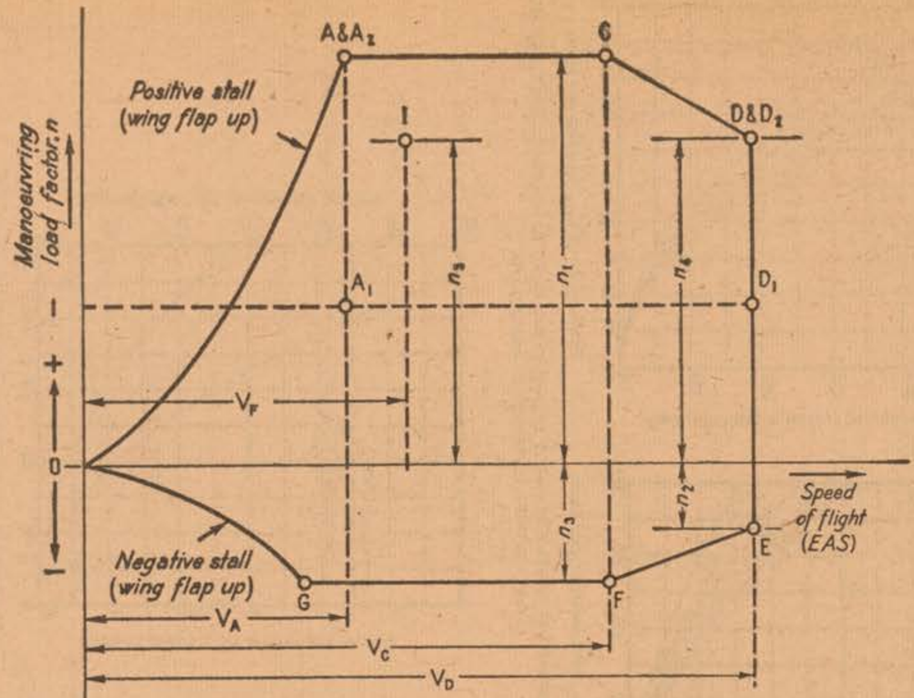


FIGURE 3-1. Maneuvering V–n diagram.

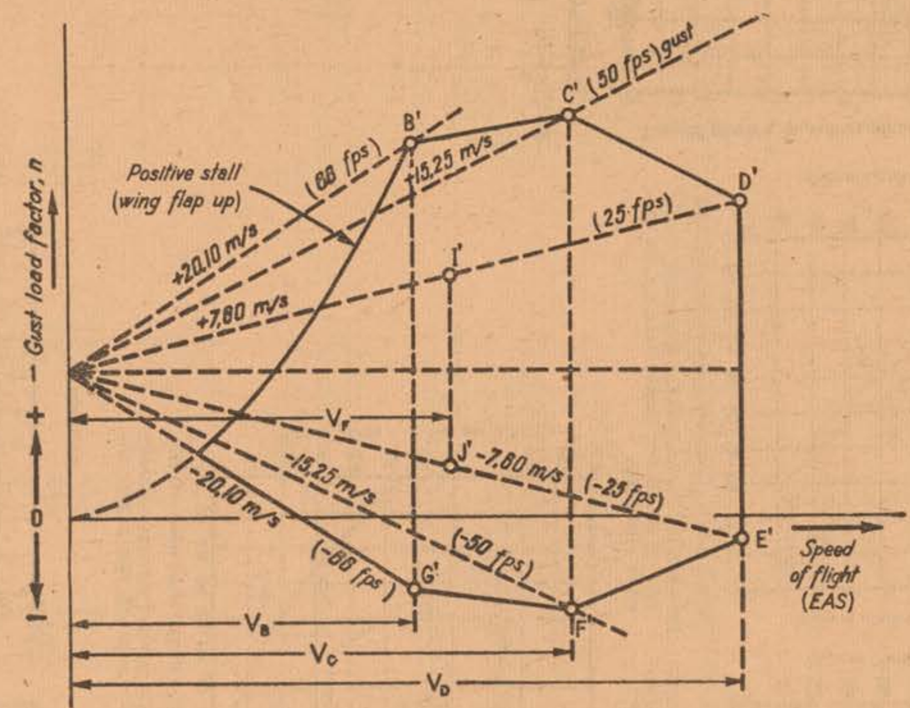


FIGURE 3-2. Gust V–n diagram.

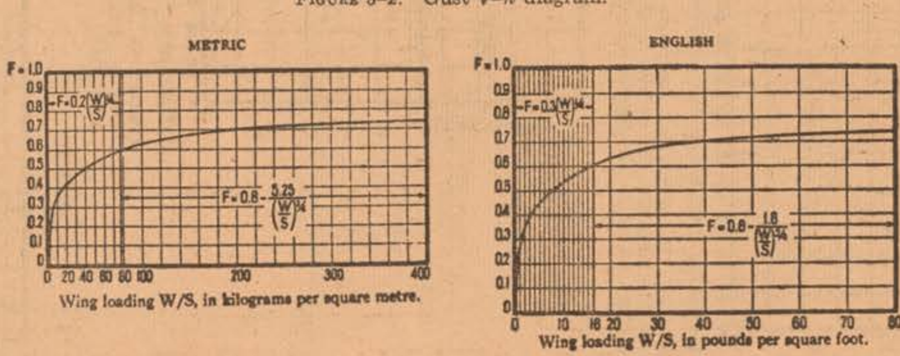


FIGURE 3-3. Alleviating factor F, for verticle gust conditions.

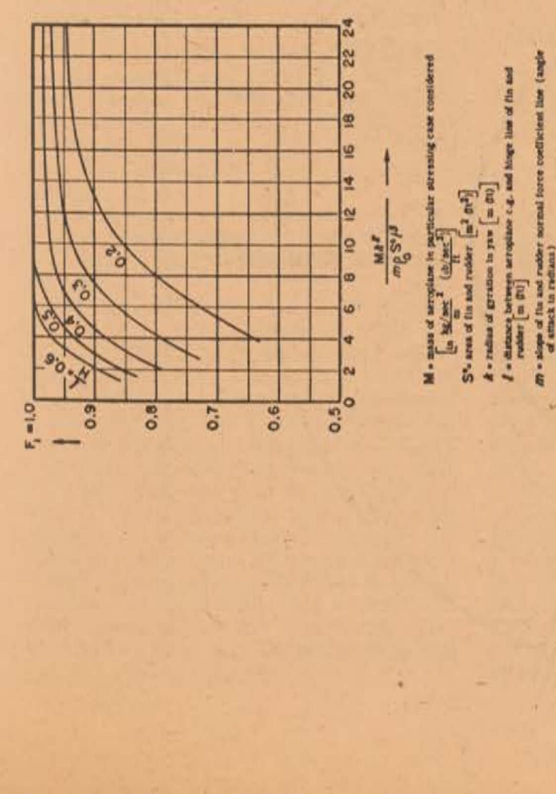


FIGURE 3-4. Alleviating factor F_l for lateral gust conditions.

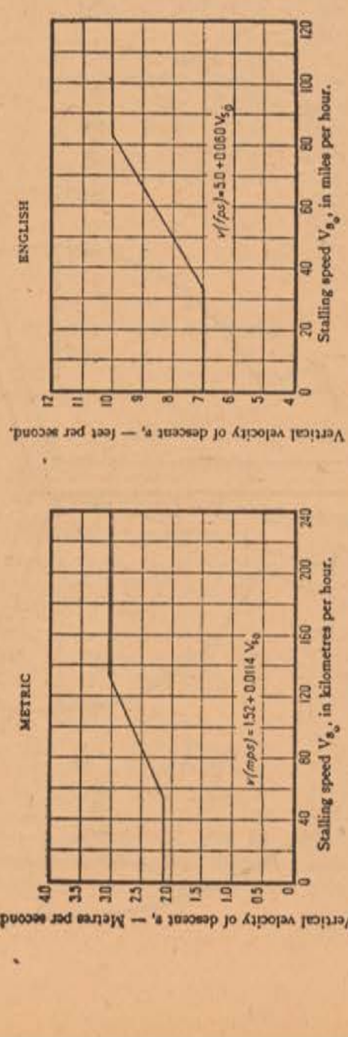


FIGURE 3-5. Limit verticle velocity of descent.

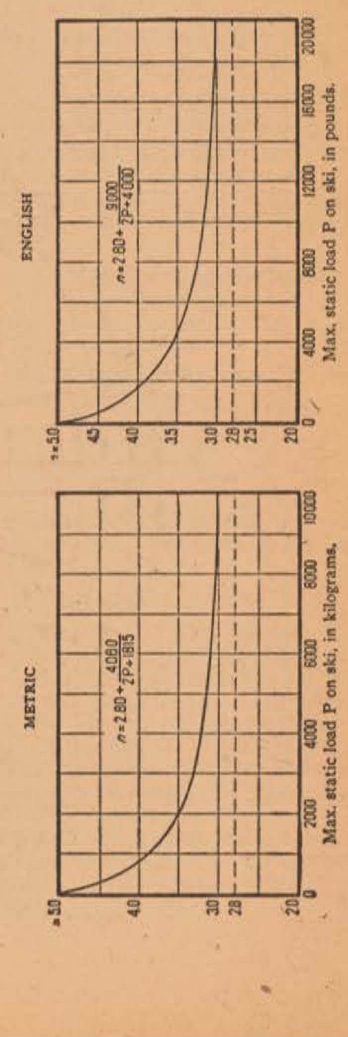


FIGURE 3-6. Load factor n for distributed up load on ski.

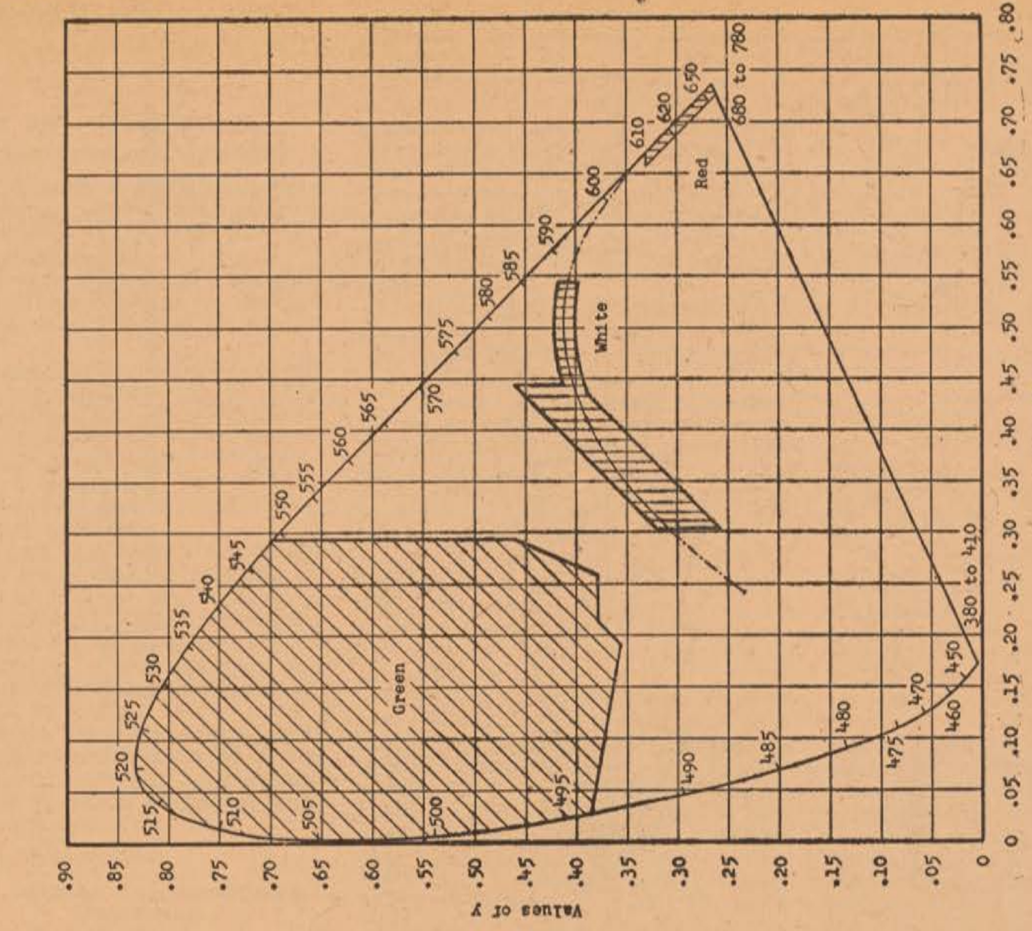


FIGURE 8-1. Navigation lights, color specifications.

NOTE: Figures on the monochromatic curve indicate wave lengths in 10^{-6} millimeters.

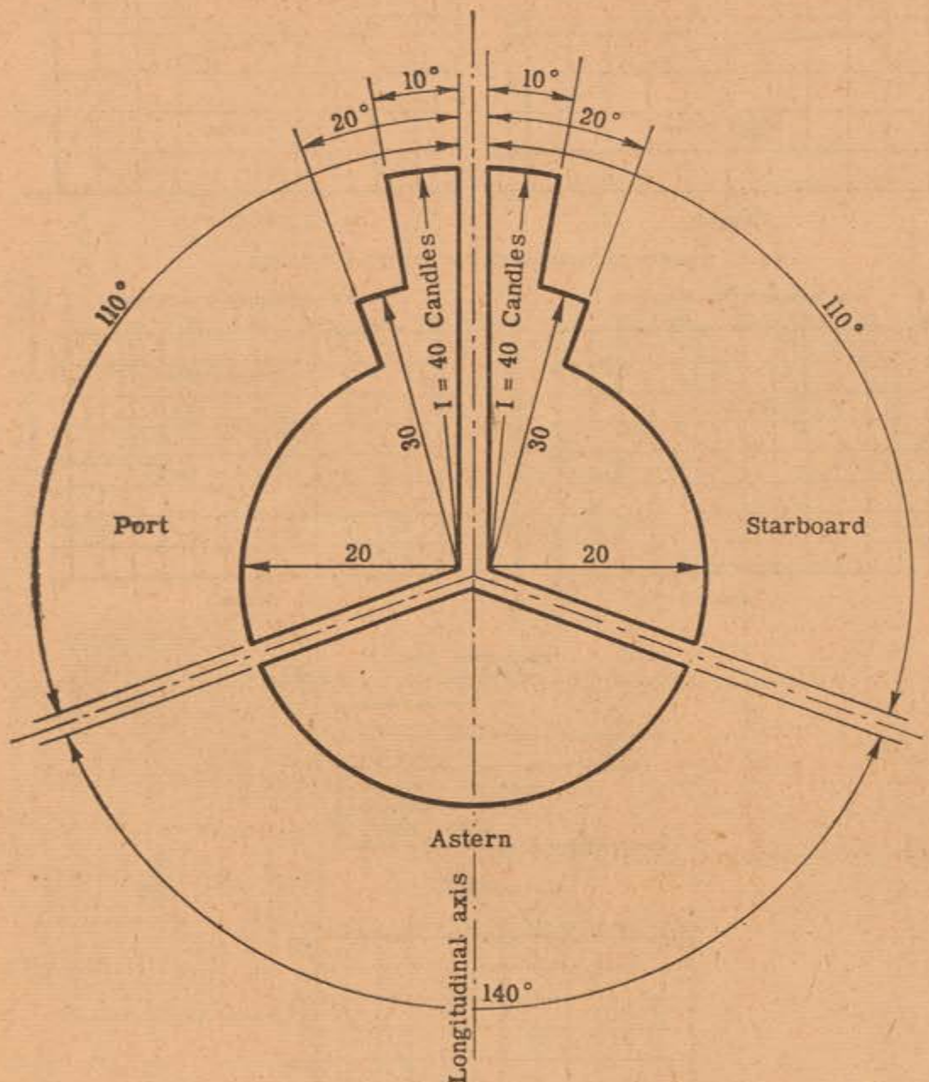


FIGURE 8-2a. Navigation lights, minimum intensity, *I*, in the horizontal plane.

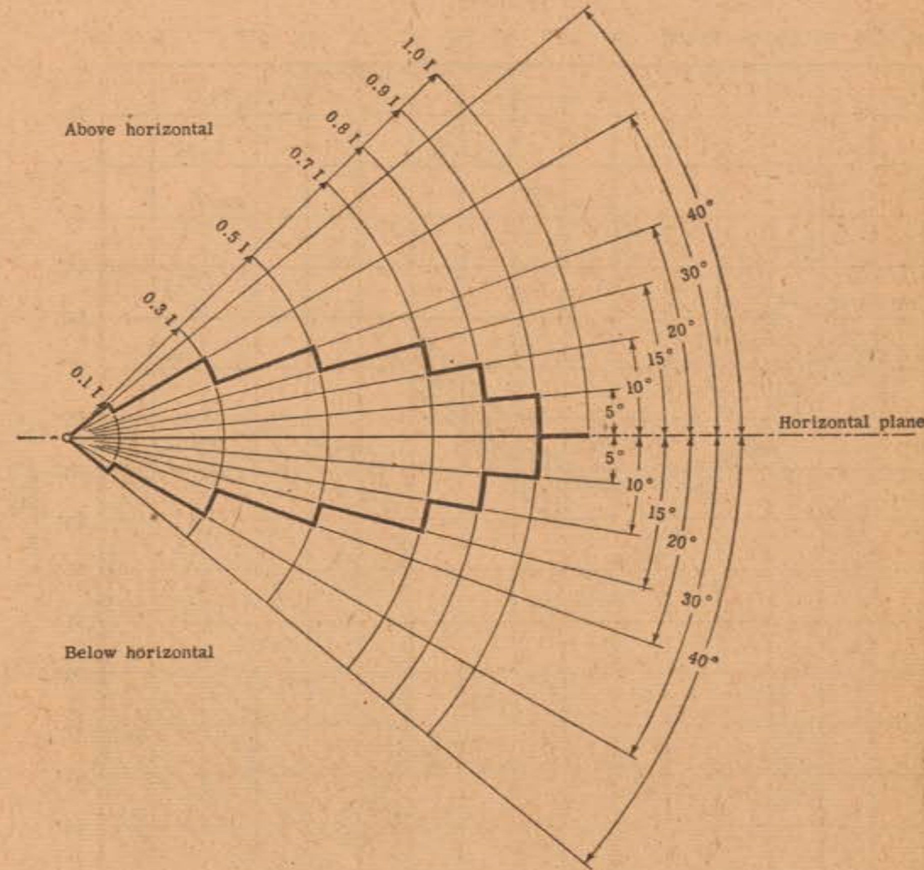


FIGURE 8-2b. Navigation lights, minimum intensities in verticle planes.

[F. R. Doc. 49-5168; Filed, July 14, 1949; 9:01 a. m.]

FEDERAL COMMUNICATIONS COMMISSION

[Docket No. 7814]

HOME NEWS PUBLISHING CO.

ORDER CONTINUING ORAL ARGUMENT

In re application of Home News Publishing Company, New Brunswick, New Jersey, Docket No. 7814, File No. BP-5129; for construction permit.

At a session of the Federal Communications Commission held at its offices in Washington, D. C., on the 7th day of July 1949;

The Commission having under consideration a letter dated June 30, 1949, from th above-entitled applicant, requesting that oral argument on the exceptions filed to the Proposed Decision in this proceeding, now scheduled for July 18, 1949, be continued until some date subsequent to August 10, 1949; and

It appearing, that counsel for the applicant will not be in the city on July 18, 1949; that counsel for the licensees of Stations WCAU and WHOL, intervenors in this proceeding, have consented to the postponement of the oral argument; and that, therefore, the request for postponement should be granted;

It is ordered, That the oral argument now scheduled for July 18, 1949, in the above-entitled proceeding is continued to a date to be set by subsequent order of the Commission.

Released: July 8, 1949.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5787; Filed, July 14, 1949; 8:51 a. m.]

[Docket Nos. 7945, 7946]

JOHNSTON BROADCASTING CO. AND THOMAS N. BEACH (WTNB)

ORDER SETTING DATE FOR ORAL ARGUMENT

In re applications of Johnston Broadcasting Company, Birmingham, Alabama, Docket No. 7945, File No. B3-P-5016; Thomas N. Beach (WTNB), Birmingham, Alabama, Docket No. 7946, File No. B3-P-5332; for construction permits.

At a session of the Federal Communications Commission held at its offices in Washington, D. C., on the 7th day of July 1949;

The United States Court of Appeals for the District of Columbia having decided on May 4, 1949, the case of *Johnston Broadcasting Company* v. *Federal Communications Commission,* reversing the decision of the Commission in the above-entitled proceeding, which granted a construction permit to Beach, and having remanded the case to the Commission for further action consistent with the decision of the Court of Appeals; the reason for the Court of Appeals decision was that the applicant Thomas N. Beach verified his application for a construction permit before the engineering permit which was subsequently attached thereto was completed.

The Commission having under consideration the petition of Thomas N. Beach, filed on May 16, 1949, requesting leave to amend his application and for final grant thereof, as amended; and the motion filed on May 26, 1949, by Johnston Broadcasting Company requesting final grant of its application and opposing Thomas N. Beach's petition for leave to amend and final grant thereof, and asking in the alternative, that the proceeding be scheduled for further oral argument;

It appearing, that similar issues of law are involved in the proceeding involving the applications of Granite City Broadcasting Company (Docket No. 8130) and St. Cloud Broadcasting Company (Docket No. 8566) for construction permits and also in the proceeding involving the applications of Hamtramck Radio Corporation (Docket No. 9021) and Atlas Broadcasting Company (Docket No. 9274) for construction permits;

It is ordered, That the petition of Thomas N. Beach and the motion of Johnston Broadcasting Company be set down for oral argument on all issues presented therein on the 26th day of September, 1949;

It is further ordered, That on the question of the authority of the Commission to permit the amendment requested, the parties direct argument, and supplemental briefs, if they desire to file such briefs, to such legal authorities as may be pertinent, including the following cases: *United States* v. *Heinszen & Co.,* 206 U. S. 370; *Atlantic Coast Line Railroad* v. *Florida,* 295 U. S. 301; *Swayne & Hoyt, Ltd.* v. *United States,* 300 U. S. 297; and *United States* v. *Morgan,* 307 U. S. 183.

It is further ordered, That Granite City Broadcasting Company, St. Cloud Broadcasting Company, Hamtramck Radio Corporation and Atlas Broadcasting Company are authorized to participate in the above-scheduled oral argument before the Commission.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5786; Filed, July 14, 1949; 8:51 a. m.]

[Docket Nos. 9123, 9339]

SUBURBAN BROADCASTING CORP. AND NEW ROCHELLE BROADCASTING SERVICE, INC.

ORDER CONTINUING HEARING

In re applications of Suburban Broadcasting Corporation, New Rochelle, New York, Docket No. 9123, File No. BP-6428; New Rochelle Broadcasting Service, Inc., New Rochelle, New York, Docket No. 9339, File No. BP-7213; for construction permits.

The Commission having under consideration the petition of New Rochelle Broadcasting Service, Inc., New Rochelle, New York, filed on June 24, 1949, requesting that the Commission continue the hearing presently scheduled for July 13, 1949, in the proceeding upon the above-entitled applications for construction permits;

It is ordered, This 1st day of July 1949, that the petition is granted; and that the hearing upon the above-entitled applications is continued to 10:00 a. m., Thursday, August 11, 1949, at Washington, D. C.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5788; Filed, July 14, 1949; 8:51 a. m.]

[Docket No. 9186]

MRS. JANE RASCOE

ORDER CONTINUING HEARING

In re application of Mrs. Jane Rascoe, Corpus Christi, Texas, Docket No. 9186, File No. BP-6784; for construction permit.

The Commission having under consideration the petition of Mrs. Jane Rascoe, Corpus Christi, Texas, filed June 28, 1949, requesting leave to amend her above-entitled application so as to specify the frequency 1560 kc, in lieu of 1580 kc; and an opposition thereto and request for a 60-day continuance of the hearing filed by the Acting General Counsel of the Federal Communications Commission on June 30, 1949; and

It appearing, That the petitioner failed to submit with the petition a formal amendment to her application as required by the Commission's rules and regulations; and that the petitioner indicated, in a telegram dated July 18, 1949, that she does not wish to proceed to hearing on the above-entitled application on July 14, 1949, as presently scheduled;

It is ordered, This 1st day of July 1949, that the petition to amend the above-entitled application is denied; and that the hearing in the above-entitled proceeding is continued to 10:00 a. m., Wednesday, September 14, 1949, at Washington, D. C.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5790; Filed, July 14, 1949; 8:51 a. m.]

[Docket No. 9242]

RADIO COMMUNICATIONS SERVICE AND SOUTHERN BELL TELEPHONE AND TELEGRAPH CO.

ORDER AMENDING ISSUE

In the matter of Radio Communications Service and Southern Bell Telephone and Telegraph Company, docket No. 9242; applications for construction permits for coastal harbor stations at Houma, Louisiana (File No. 1429-F1-P-D) and Abbeville and St. Bernard, Louisiana (Files Nos. 2226-PC-C and 2227-PC-C), respectively.

At a session of the Federal Communications Commission held at its office in Washington, D. C., on the 6th day of July 1949;

The Commission, having under consideration its order of March 9, 1949, herein, the petition filed by Southern Bell Telephone and Telegraph Company for authority to amend its applications for construction permits and the motion filed by said Company to change the issues in the aforesaid order of March 9, 1949, by substituting, in issue No. 3 thereof, the frequencies 2510 kc. and 2146 kc. in lieu of the frequencies 2606 kc. and 2190 kc., respectively; and

It appearing, that proper grounds for the grant of the relief sought in such petition and motion have been shown, and there being no opposition thereto;

It is ordered, That the aforementioned petition and motion, respectively, of Southern Bell Telephone and Telegraph Company are granted; and

It is further ordered, That issue No. 3 of the Commission's order of March 9, 1949, in the above-entitled proceeding is amended to read as follows:

3. To determine whether the proposed coastal harbor station transmitting frequency 2510 kc. and the proposed ship transmitting frequency 2146 kc. may be made available to the maritime mobile service and, if so, whether such frequencies may be assigned, pursuant to the rules and regulations of the Commission, to the Telephone Company's proposed public coastal harbor stations at Abbeville and St. Bernard, Louisiana, and to ship telephone stations for communication with these coastal harbor stations, respectively.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5785; Filed, July 14, 1949; 8:50 a. m.]

[Docket No. 9243]

HARVEY E. SEIBERT ET AL.

ORDER AMENDING ISSUE

In the matter of Harvey E. Seibert and Clinton D. McKinnon and The Pacific Telephone and Telegraph Company, Docket No. 9243; applications for construction permits for coastal harbor stations at San Diego, California (File No. 10257-F1-P-C), and at San Pedro, California (File No. 11682-F1-P-C), respectively.

At a session of the Federal Communications Commission held at its offices in Washington, D. C. on the 6th day of July 1949;

The Commission, having under consideration its order of March 9, 1949 herein, the petition filed by The Pacific Telephone and Telegraph Company for authority to amend its application for construction permit and the motion filed by said Company to change the issues in the aforesaid order of March 9, 1949 by substituting, in issue No. 3 thereof, the frequencies 2758 kc. and 2292 kc. in lieu of the frequencies 2766 kc. and 2074 kc., respectively; and

It appearing, that proper grounds for the grant of the relief sought in such petition and motion have been shown, and there being no opposition thereto;

It is ordered, That the aforementioned petition and motion, respectively, of The Pacific Telephone and Telegraph Company are granted; and

It is further ordered, That issue No. 3 of the Commission's order of March 9, 1949, in the above-entitled proceeding is amended to read as follows:

3. To determine whether the proposed coastal harbor station transmitting frequency 2758 kc. and the proposed ship transmitting frequency 2292 kc. may be made available to the maritime mobile service and, if so, whether such frequencies may be assigned to the Telephone Company's proposed public coastal harbor station at San Pedro, California, and to ship telephone stations for communication with the coastal harbor station, respectively.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5784; Filed, July 14, 1949; 8:50 a. m.]

[Docket Nos. 9253, 9254]

WOAX, INC. (WTNJ), AND MORRISVILLE BROADCASTING CO. (WBUD)

ORDER CONTINUING HEARING

In re applications of WOAX, Inc. (WTNJ), Trenton, New Jersey, Docket No. 9253, File No. BP-6845; Morrisville Broadcasting Company (WBUD), Morrisville, Pennsylvania, Docket No. 9254, File No. BP-6967; for construction permits.

The Commission having under consideration the petition of Morrisville Broadcasting Company (WBUD), Morrisville, Pennsylvania, requesting a 45-day continuance of the hearing presently scheduled for July 11, 1949, at Washington, D. C., in the proceeding upon the above-entitled applications for construction permits; and

It appearing, that no opposition to the granting of the said petition has been filed with the Commission;

It is ordered, This 1st day of July 1949, that the petition is granted; and that the hearing upon the above-entitled applications is continued to 10:00 a. m., Tuesday, August 30, 1949, at Washington, D. C.

FEDERAL COMMUNICATIONS COMMISSION,
[SEAL] T. J. SLOWIE,
Secretary.

[F. R. Doc. 49-5789; Filed, July 14, 1949; 8:51 a. m.]

FEDERAL DEPOSIT INSURANCE CORPORATION

INSURED MUTUAL SAVINGS BANKS NOT MEMBERS OF THE FEDERAL RESERVE SYSTEM

RESOLUTION AUTHORIZING CALL FOR REPORT OF CONDITION

Pursuant to the provisions of paragraph (3) of subsection (k) of section 12B of the Federal Reserve Act, as amended, be it resolved that each insured mutual savings bank not a member of the Federal Reserve System, be, and hereby is, required to submit to the Federal Deposit Insurance Corporation within ten days after receipt of notice of this resolution a report of its condition as of the close of business Thursday, June 30, 1949, on Form 64 (Savings). Said report of condition shall be prepared in accordance with, "Instructions for the Preparation of Report of Condition on Form 64 (Savings) and Report of Earnings and Dividends on Form 73 (Savings) by Insured Mutual Savings Banks," issued December, 1945.

FEDERAL DEPOSIT INSURANCE CORPORATION,
[SEAL] E. F. DOWNEY,
Secretary.

[F. R. Doc. 49-5780; Filed, July 14, 1949; 8:48 a. m.]

INSURED STATE BANKS NOT MEMBERS OF THE FEDERAL RESERVE SYSTEM EXCEPT BANKS IN THE DISTRICT OF COLUMBIA AND MUTUAL SAVINGS BANKS

RESOLUTION AUTHORIZING CALL FOR REPORT OF CONDITION

Pursuant to the provisions of paragraph (3) of subsection (k) of section 12B of the Federal Reserve Act, as amended, be it resolved that each insured State bank not a member of the Federal Reserve System, except a bank in the District of Columbia and a mutual savings bank, be, and hereby is, required to submit to the Federal Deposit Insurance Corporation within ten days after receipt of notice of this resolution a report of its condition as of the close of business Thursday, June 30, 1949, on Form 64 (Short form)—Call No. 31. Said report of condition shall be prepared in accordance with, "Instructions for the Preparation of Report of Condition on Form 64 (Short form)," issued December 1946, and supplement of June 24, 1948.

FEDERAL DEPOSIT INSURANCE CORPORATION,
[SEAL] E. F. DOWNEY,
Secretary.

[F. R. Doc. 49-5781; Filed, July 14, 1949; 8:48 a. m.]

FEDERAL POWER COMMISSION

[Docket No. E-6116]

KANSAS POWER AND LIGHT CO.

NOTICE OF ORDER DETERMINING CONTINUATION OF EMERGENCY AND AMENDING GRANTING OF EXEMPTION FOR USE OF INTERCONNECTION

JULY 12, 1949.

Notice is hereby given that, on July 8, 1949, the Federal Power Commission issued its order entered July 7, 1949, in the above designated matter, amending the order dater March 9, 1948 (published in the FEDERAL REGISTER on March 17, 1948 (Vol. 13, No. 53, P. 1384)) determining continuation of emergency and granting of exemption for use of interconnection until March 31, 1950.

[SEAL] LEON M. FUQUAY,
Secretary.

[F. R. Doc. 49-5772; Filed, July 14, 1949; 8:46 a. m.]

[Docket No. E-6214]

TELLURIDE POWER CO.

NOTICE OF ORDER AUTHORIZING ISSUANCE OF SECURITIES

JULY 12, 1949.

Notice is hereby given that, on July 7, 1949, the Federal Power Commission issued its order entered July 7, 1949, authorizing issuance of securities in the above-designated matter.

[SEAL] LEON M. FUQUAY, *Secretary.*

[F. R. Doc. 49-5773; Filed, July 14, 1949; 8:47 a. m.]

[Docket No. G-1204]

LONE STAR GAS CO.

NOTICE OF FINDINGS AND ORDER ISSUING CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AND PERMITTING ABANDONMENT OF FACILITIES

JULY 12, 1949.

Notice is hereby given that, on July 8, 1949, the Federal Power Commission issued its findings and order entered July 7, 1949, issuing certificate of public convenience and necessity and permitting abandonment of facilities in the above-designated matter.

[SEAL] LEON M. FUQUAY, *Secretary.*

[F. R. Doc. 49-5770; Filed, July 14, 1949; 8:46 a. m.]

[Project No. 1951]

GEORGIA POWER CO.

NOTICE OF ORDER EXTENDING TIME FOR FILING REVISED EXHIBITS

JULY 11, 1949.

Notice is hereby given that, on July 11, 1949, the Federal Power Commission issued its order entered July 7, 1949, extending time until December 31, 1949, for filing revised exhibits in the above-designated matter.

[SEAL] LEON M. FUQUAY, *Secretary.*

[F. R. Doc. 49-5771; Filed, July 14, 1949; 8:46 a. m.]

SECURITIES AND EXCHANGE COMMISSION

[File No. 7-1100]

CONSOLIDATED EDISON CO. OF NEW YORK, INC.

FINDINGS AND ORDER GRANTING APPLICATION

At a regular session of the Securities and Exchange Commission, held at its office in the city of Washington, D. C., on the 11th day of July A. D. 1949.

In the matter of application by the Detroit Stock Exchange for unlisted trading privileges in Consolidated Edison Company of New York, Inc.; File No. 7-1100.

The Detroit Stock Exchange has made application to the Commission pursuant to section 12 (f) (2) of the Securities Exchange Act of 1934 and Rule X-12F-1 for permission to extend unlisted trading privileges to the Common Stock, No Par Value, of Consolidated Edison Company of New York, Inc.

No. 135——8

After appropriate notice and opportunity for hearing and in the absence of any request by any interested person for hearing on this matter, the Commission on the basis of the facts submitted in the application makes the following findings:

(1) That this security is registered and listed on the New York Stock Exchange; that the geographical area deemed to constitute the vicinity of the Detroit Stock Exchange is the State of Michigan; that out of a total of 11,476,527 shares outstanding, 140,583 shares are owned by 1,842 shareholders in the vicinity of the Detroit Stock Exchange; and that in the vicinity of the Detroit Stock Exchange there were effected 367 transactions involving 27,705 shares from April 1, 1948, to April 1, 1949;

(2) That sufficient public distribution of, and sufficient public trading activity in, this security exist in the vicinity of the applicant exchange to render the extension of unlisted trading privileges thereto appropriate in the public interest and for the protection of investors; and

(3) That the extension of unlisted trading privileges on the applicant exchange to this security is otherwise appropriate in the public interest and for the protection of investors.

Accordingly it is ordered, Pursuant to section 12 (f) (2) of the Securities Exchange Act of 1934, that the application of the Detroit Stock Exchange for permission to extend unlisted trading privileges to the Common Stock, No Par Value, of Consolidated Edison Company of New York, Inc. be, and the same is, hereby granted.

By the Commission.

[SEAL] ORVAL L. DUBOIS, *Secretary.*

[F. R. Doc. 49-5778; Filed, July 14, 1949; 8:48 a. m.]

[File No. 70-2153]

KANSAS POWER AND LIGHT CO. AND KANSAS ELECTRIC POWER CO.

ORDER GRANTING AND PERMITTING APPLICATION-DECLARATION TO BECOME EFFECTIVE

At a regular session of the Securities and Exchange Commission held at its office in the city of Washington, D. C., on the 7th day of July 1949.

The Kansas Power and Light Company ("Kansas Power") and its subsidiary, The Kansas Electric Power Company ("Kansas Electric"), both being subsidiaries of North American Light & Power Company and The North American Company, both registered holding companies, having filed with this Commission a joint application-declaration, and amendments thereto, pursuant to Sections 6, 7, 9, 10 and 12 of the Public Utility Holding Company Act of 1935 and the rules and regulations promulgated thereunder regarding, among other things, the merger of Kansas Electric into Kansas Power and the exchange of new preferred stock of Kanas Power for outstanding publicly held preferred stock of Kansas Power and Kansas Electric; and

A public hearing having been held, after appropriate notice, with respect to said joint application-declaration, as amended, and the Commission having considered the record and having filed its findings and opinion herein:

It is ordered, That said joint application-declaration, as amended, be, and the same hereby is, granted and permitted to become effective forthwith, subject to the terms and conditions prescribed by Rule U-24.

By the Commission.

[SEAL] ORVAL L. DUBOIS, *Secretary.*

[F. R. Doc. 49-5776; Filed, July 14, 1949; 8:47 a. m.]

[File No. 70-2166]

NEW YORK POWER & LIGHT CORP. AND TICONDEROGA ELECTRIC LIGHT AND POWER CO.

ORDER GRANTING APPLICATION AND PERMITTING DECLARATION TO BECOME EFFECTIVE

At a regular session of the Securities and Exchange Commission, held at its office in the city of Washington, D. C., on the 8th day of July 1949.

New York Power and Light Corporation ("New York Power"), a subsidiary of Niagara Hudson Power Corporation, a registered holding company and The Ticonderoga Electric Light and Power Company ("Ticonderoga"), a subsidiary of New York Power, having filed a joint application-declaration pursuant to sections 9, 10 and 12 of the Public Utility Holding Company Act of 1935 and Rule U-43 promulgated thereunder, with respect to the merger of Ticonderoga into New York Power pursuant to Section 85 of the Stock Corporation Law of the State of New York, which merger was approved by the Public Service Commission of the State of New York by order dated June 1, 1949; and

Applicants-declarants having requested that the order of the Commission herein conform to the formal requirements specified in Supplement R and section 1808 (f) of the Internal Revenue Code, as amended, and contain the recitals and specifications prescribed therein; and

Said application-declaration having been duly filed and notice of said filing having been duly given in the form and manner prescribed by Rule U-23 promulgated pursuant to said act, and the Commission not having received a request for hearing with respect to said application-declaration within the period specified in said notice, or otherwise, and not having ordered a hearing thereon; and

The Commission finding with respect to said application-declaration that the requirements of the applicable provisions of the act and rules thereunder are satisfied, and that no adverse findings are necessary, and deeming it appropriate in the public interest and in the interest

of investors and consumers that said application-declaration be granted and permitted to become effective, and further deeming it appropriate to grant the request of applicants-declarants with respect to the recitals conforming to the requirements specified in Supplement R and section 1808 (f) of the Internal Revenue Code, as amended:

It is hereby ordered, Pursuant to Rule U-23 and the applicable provisions of said act and subject to the terms and conditions prescribed in Rule U-24, that the aforesaid application-declaration be and the same hereby is, granted and permitted to become effective forthwith.

It is further ordered and recited, That the transactions proposed in the aforesaid application-declaration to be effected by New York Power, including particularly the transactions hereinafter described and recited, are necessary or appropriate to effectuate the provisions of subsection (b) of section 11 of the Public Utility Holding Company Act of 1935 and are hereby authorized, approved and directed:

The transfer or conveyance to New York Power upon and by the effect of the merger of Ticonderoga into New York Power of all the rights, title and interest of Ticonderoga in and to any lands, tenements or realty.

By the Commission.

[SEAL] ORVAL L. DUBOIS, *Secretary*.

[F. R. Doc. 49-5777; Filed, July 14, 1949; 8:48 a. m.]

DEPARTMENT OF JUSTICE

Office of Alien Property

AUTHORITY: 40 Stat. 411, 55 Stat. 839, Pub. Laws 322, 671, 79th Cong., 60 Stat. 50, 925; 50 U. S. C. and Supp. App. 1, 616; E. O. 9193, July 6, 1942, 3 CFR, Cum. Supp., E. O. 9567, June 8, 1945, 3 CFR, 1945 Supp., E. O. 9788, Oct. 14, 1946, 11 F. R. 11981.

[Vesting Order 13394]

WILLIAM BECKER

In re: Trust under Will of William Becker, deceased. File No. D-66-323; E. T. Sec. 2525.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Elizabeth Troeger, a/k/a Allie Troeger, Ilse Wahl, and Lotte Troeger, whose last known address is Germany, are residents of Germany and nationals of a designated enemy country (Germany);

2. That the issue, names unknown, of Elizabeth Troeger, a/k/a Allie Troeger, who there is reasonable cause to believe are residents of Germany, are nationals of a designated enemy country (Germany);

3. That all right, title, interest and claim of any kind or character whatsoever of the persons identified in subparagraphs 1 and 2 hereof, and each of them, in and to the trust created under the will of William Becker, deceased, is property payable or deliverable to, or claimed by, the aforesaid nationals of a designated enemy country (Germany);

4. That such property is in the process of administration by the First Wisconsin Trust Company, as trustee, acting under the judicial supervision of the Milwaukee County Court, Milwaukee, Wisconsin;

and it is hereby determined:

5. That to the extent that the persons named in subparagraph 1 hereof and the issue, names unknown, of Elizabeth Troeger, a/k/a Allie Troeger, are not within a designated enemy country, the national interest of the United States requires that such persons be treated as nationals of a designated enemy country (Germany).

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest,

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

The terms "national" and "designated enemy country" as used herein shall have the meanings prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on June 14, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON, *Assistant Attorney General, Director, Office of Alien Property*.

[F. R. Doc. 49-5793; Filed, July 14, 1949; 8:52 a. m.]

[Vesting Order 13398]

JOHANNA DREHER

In re: Estate of Johanna Dreher, deceased. File No. D-28-12361; E. T. Sec. 16580.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Alois Dreher and Franz X. Schmid, whose last known address was, on May 3, 1949, Germany, were on such date residents of Germany and nationals of a designated enemy country (Germany);

2. That the sum of $2,306.95 was paid to the Attorney General of the United States by Ann Stoby, Administratrix of the estate of Johanna Dreher, deceased;

3. That the said sum of $2,306.95 was accepted by the Attorney General of the United States on May 3, 1949, pursuant to the Trading With the Enemy Act, as amended;

4. That the said sum of $2,306.95 is presently in the possession of the Attorney General of the United States and was property within the United States owned or controlled by, payable or deliverable to, held on behalf of or on account of, or owing to, or which was evidence of ownership or control by, the aforesaid nationals of a designated enemy country (Germany);

and it is hereby determined:

5. That to the extent that the persons named in subparagraph 1 hereof were not within a designated enemy country on May 3, 1949, the national interest of the United States required that such persons be treated as nationals of a designated enemy country (Germany) on such date.

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest,

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

This vesting order is issued nunc pro tunc to confirm the vesting of the said property by acceptance as aforesaid.

The terms "national" and "designated enemy country" as used herein shall have the meanings prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on June 14, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON, *Assistant Attorney General, Director, Office of Alien Property*.

[F. R. Doc. 49-5794; Filed, July 14, 1949; 8:52 a. m.]

[Vesting Order 13457]

BECKER & CO.

In re: Debt owing to Becker & Co. F-39-6426-C-1.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Becker & Co., the last known address of which is P. O. Box 87, Osaka, Japan, is a partnership organized under the laws of Japan, and which has or, since the effective date of Executive Order 8389, as amended, has had its principal place of business in Osaka, Japan, and is a national of a designated enemy country (Japan);

2. That the property described as follows: That certain debt or other obligation owing to Becker & Co., by The A. J. Alsdorf Corporation, 221 N. La Salle Street, Chicago, Illinois, in the amount of $606.59, as of December 31, 1945, together with any and all accruals thereto, and any and all rights to demand, enforce and collect the same,

is property within the United States owned or controlled by, payable or deliverable to, held on behalf of or on account of, or owing to, or which is evidence of ownership or control by, the aforesaid national of a designated enemy country (Japan);

and it is hereby determined:

3. That to the extent that the person named in subparagraph 1 hereof is not within a designated enemy country, the national interest of the United States requires that such person be treated as

a national of a designated enemy country (Japan).

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest,

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

The terms "national" and "designated enemy country" as used herein shall have the meanings prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on June 21, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5795; Filed, July 14, 1949; 8:52 a. m.]

[Vesting Order 13471]

NARI KAUFMANN

In re: Bank account owned by Nari Kaufmann. F-63-6276-E-1.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Nari Kaufmann, on or since the effective date of Executive Order 8389, as amended, and on or since December 8, 1941, has been a resident of Japan and is a national of a designated enemy country (Japan);

2. That the property described as follows: That certain debt or other obligation of The National City Bank of New York, 55 Wall Street, New York, New York, arising out of a Savings Account, account number A103651, entitled Dr. J. A. F. Paravicini, maintained at the aforesaid bank, and any and all rights to demand, enforce and collect the same,

is property within the United States owned or controlled by, payable or deliverable to, held on behalf of or on account of, owing to, or which is evidence of ownership or control by, Nari Kaufmann, the aforesaid national of a designated enemy country (Japan);

and it is hereby determined:

3. That to the extent that the person named in subparagraph 1 hereof is not within a designated enemy country, the national interest of the United States requires that such person be treated as a national of a designated enemy country (Japan).

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest,

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

The terms "national" and "designated enemy country" as used herein shall have the meanings prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on June 21, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5797; Filed, July 14, 1949; 8:52 a. m.]

[Vesting Order 13523]

KITINOSUKE MATSUI

In re: Cash owned by Kitinosuke Matsui. D-39-7267-E-1.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Kitinosuke Matsui, whose last known address is Japan, is a resident of Japan and a national of a designated enemy country (Japan);

2. That the property described as follows: Cash in the sum of $217.92, presently in the possession of the Treasury Department of the United States in Trust Fund Account, Symbol 158915, "Deposits, Funds of Civilian Internees and Prisoners of War," in the name of Kitinosuke Matsui, and any and all rights to demand, enforce and collect the same,

is property within the United States owned or controlled by, payable or deliverable to, held on behalf of or on account of, or owing to, or which is evidence of ownership or control by, Kitinosuke Matsui, the aforesaid national of a designated enemy country (Japan):

and it is hereby determined:

3. That to the extent that the person named in subparagraph 1 hereof is not within a designated enemy country, the national interest of the United States requires that such person be treated as a national of a designated enemy country (Japan).

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest,

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

The terms "national" and "designated enemy country" as used herein shall have the meanings prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on July 6, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5798; Filed, July 14, 1949; 8:52 a. m.]

[Vesting Order 8711, Amdt.]

EXPORTKREDITBANK A. G.

In re: Bonds, stocks, checks or other credit instruments and other property owned by Exportkreditbank A. G.

Vesting Order 8711, dated April 14, 1947, is hereby amended as follows and not otherwise:

1. By deleting from Exhibit A attached to and by reference made a part of the aforesaid Vesting Order 8711 the figures "£100" set forth with respect to the face value of United States of Brazil Funding 20-year 5% Bond of 1931 and substituting therefor the figures "$100.00".

2. By deleting from Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 the name of the registered owner "James I. De Rosset" set forth with respect to one hundred (100) shares of Central States Electric Corporation 6% Cumulative Preferred stock and substituting therefor the name "James L. De Rosset".

3. By deleting from Exhibit A attached to and by reference made a part of the aforesaid Vesting Order 8711 the figures "100" set forth with respect to the face value of Republic of Mexico Consolidated External Loan of 1899, 5% Bond, and substituting therefor the figures "£100".

4. By inserting in Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 under the heading "Registered Owner" and opposite the certificate number NCO 13315 for one (1) share of common stock of General Investment Corporation, 941 North Meridian Street, Indianapolis, Indiana the name "Lee & Co."

5. By deleting from Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 the words "Middle West Utilities Company of Canada, Ltd., Sault Ste. Marie, Ontario, Canada" and substituting therefor the words "Middle West Utilities Co. (Delaware)".

6. By deleting from Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 the words and figures "1st Cumulative Preferred" and the figure "3.50" set forth under the headings "Type of Stock" and "Par Value" respectively set forth with respect to 36 shares of Radio Corporation of America stock and substituting therefor the words and figures "$3.50 Cumulative 1st Preferred (Foreign)" and "No" respectively.

7. By adding to Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 opposite the words "United Fruit Company, 1 Federal Street, Boston, Massachusetts" and under the headings "Certificate Numbers" and "No. of Shares" the figures "J-57654" and "100" respectively.

8. By deleting from Exhibit B attached to and by reference made a part of the aforesaid Vesting Order 8711 the certificate numbers "TJ4596-TJ4597-TJ4598-TJ4599-TJ4600" set forth with respect to 500 shares of Common Temporary stock of Vertientes-Camaguey Sugar Company and substituting therefor the certificate numbers "N3830-N3831-N3832-N3833-N3834".

9. By deleting from Exhibit C attached to and by reference made a part of the

aforesaid Vesting Order 8711 the figures "4 @ £ 2-5-0" set forth with respect to the face value of United States of Brazil 5% Bonds and substituting therefor the figures "4 @ $2.50."

10. By deleting from Exhibit D attached to and by reference made a part of the aforesaid Vesting Order 8711 the words "none stated" and the figures "7/1200ths" set forth with respect to scrip certificates for stock of The Commonwealth and Southern Corporation, 902 Market Street, Wilmington, Delaware, and

11. By deleting from Exhibit D attached to and by reference made a part of the aforesaid Vesting Order 8711 the figures "2/80ths" opposite the Certificate Number SC2484 set forth with respect to scrip certificates for stock of The Commonwealth and Southern Corporation, 902 Market Street, Wilmington, Delaware, and substituting therefor the figures "7/1200ths".

All other provisions of said Vesting Order 8711 and all actions taken by or on behalf of the Attorney General of the United States in reliance thereon, pursuant thereto and under the authority thereof are hereby ratified and confirmed.

Executed at Washington, D. C. on July 6, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5799; Filed, July 14, 1949; 8:52 a. m.]

[Return Order 363]

EUGENE FREYSSINET

Having considered the claim set forth below and having issued a determination allowing the claim, which is incorporated by reference herein and filed herewith,

It is ordered, That the claimed property, described below and in the determination, including all royalties accrued thereunder and all damages and profits recoverable for past infringement thereof, be returned after adequate provision for taxes and conservatory expenses:

Claimant, Claim No., Notice of Intention To Return Published, and Property

Eugene Freyssinet, Neuilly-sur-Seine (Seine), France, Claim No. 25120, February 15, 1949 (14 F. R. 678); Property described in Vesting Order No. 666 (8 F. R. 5047, April 17, 1943), relating to United States Letters Patent Nos. 1,931,956; 2,048,253; 2,052,818; 2,099,265; 2,172,703; 2,226,201 and 2,270,240 and a ½ interest in United States Letters Patent No. 2,080,074; and property described in Vesting Order 293 (7 F. R. 9836, November 26, 1942), relating to Patent Applications Ser. No. 282,958 (now Patent No. 2,306,160), and Ser. No. 377,041 (now Patent No. 2,371,882). The return shall not be deemed to include the rights of any licensees under any of the above patents. It will include the rights of the Attorney General under any licenses issued by the Alien Property Custodian or the Attorney General relating to the above-described property.

Appropriate documents and papers effectuating this order will issue.

Executed at Washington, D. C., on July 8, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5801; Filed, July 14, 1949; 8:53 a. m.]

CHARLES LOUIS KLINGELHOFER

NOTICE OF INTENTION TO RETURN VESTED PROPERTY

Pursuant to section 32 (f) of the Trading With the Enemy Act, as amended, notice is hereby given of intention to return, on or after 30 days from the date of the publication hereof, the following property, subject to any increase or decrease resulting from the administration thereof prior to return, and after adequate provision for taxes and conservatory expenses:

Claimant, Claim No., Property, and Location

Charles Louis Klingelhofer, Hyattsville, Maryland, 41068; One-hundred and twenty (120) shares of the no par value common stock of The Commonwealth and Southern Corporation, a Delaware corporation, evidenced by stock certificate No. 430927 representing 100 shares and stock certificate No. 548205 representing 20 shares, both certificates registered in the name of the Attorney General of the United States, Account No. 28-31482, presently in the custody of the Safekeeping Department of the Federal Reserve Bank of New York.

Executed at Washington, D. C., on July 8, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
Director, Office of Alien Property.

[F. R. Doc. 49-5802; Filed, July 14, 1949, 8:53 a. m.]

ALPHONSE CALANDRA

NOTICE OF INTENTION TO RETURN VESTED PROPERTY

Pursuant to section 32 (f) of the Trading With the Enemy Act, as amended, notice is hereby given of intention to return, on or after 30 days from the date of the publication hereof, the following property, subject to any increase or decrease resulting from the administration thereof prior to return, and after adequate provision for taxes and conservatory expenses:

Claimant, Claim No., Property, and Location

Alphonse Calandra, Little Falls, New Jersey, 1611; Twenty-four (24) shares of no par value capital stock of Ocean Land, Inc., a New York corporation, evidenced by stock certificate No. 13, registered in the name of the Alien Property Custodian, Washington, D. C., Account No. 38-9483, presently in the custody of the Safekeeping Department of the Federal Reserve Bank of New York.

Executed at Washington, D. C., on July 8, 1949.

For the Attorney General.

[SEAL] DAVID L. BAZELON,
Assistant Attorney General,
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